UNIVERSITY OF PENNSYLVANIA

CYCLICAL FLUCTUATIONS IN THE SHIPPING AND SHIPBUILDING INDUSTRIES

F. CYRIL JAMES

A THESIS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

PHILADELPHIA
1927

CYCLICAL FLUCTUATIONS IN THE SHIPPING AND SHIPBUILDING INDUSTRIES

A THESIS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL OF THE UNIVERSITY OF PENNSYLVANIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

F. CYRIL JAMES

PHILADELPHIA
1927

R. UNIV.
BIBLIOTHEEK
LEIDEN

PREFACE

Rerum cognoscere causas

The business cycle is one of the most absorbing of economic phenomena, if one may judge by the number of treatises that have been written in that field. Even the fluctuations in the prosperity of shipping are known to have been the subject of inquiries as old as the Minoan Civilisation of Crete and the Rhodian Sea Law. Perhaps then something may be gained from an attempt to measure those fluctuations in a manner similar to that by which almost every other industry has been treated, and it is to this end that this study has been undertaken.

Beginning with ocean freights, the analysis will be extended to embrace the profits of shipping companies and the price of vessels—three factors which stand in very close relationship to one another. The conclusions reached by this method will be tested by means of the recorded figures of the volume of trade, of the movement of shipping and of shipbuilding. The vastness of such a field of study has made some very definite limitation necessary, and for this reason the analysis has been limited to British shipping during the period subsequent to 1880—largely owing to the scarcity of available data before this time in the case of Great Britain, and to the international importance of the British mercantile marine.

A large part of the material used has been furnished in letters from, and conversations with, men in the shipping industry itself, and the writer wishes to thank all those who by their cordial co-operation have made his task possible. In particular, he wishes to express his gratitude to Mr. J. E. Saugstad of the United States Shipping Board, and Dr. Isserliss, Statistician of the Chamber of Shipping of the United Kingdom for their criticism and advice as to the scope and method of this study; to Dr. Frank Parker for his assistance in the general treatment of the business cycle and for many helpful suggestions; and to Dr. Lincoln W. Hall for his valuable advice in the matter of

statistical treatment of the data as well as for permission to make use of some of his unpublished methods. Finally, a tribute is due to Dean Emory R. Johnson for the inspiration which prompted the study and for his generous assistance in solving the problems which attended its inception.

FRANK CYRIL JAMES.

University of Pennsylvania
January 31, 1926.

CONTENTS

PAGES

Preface 3

Table of Contents 5

Index to Statistical Tables 7

Index to Charts 8

I

Shipping and the Business Cycle 9

II

Thirty-five Years of Ship Operation 19

III

The Shipbuilding Industry 41

IV

Shipping in the Post-war Period 56

V

The Shipping Cycle 67

Bibliography 72

Appendix: Statistical Method 73

Statistical Tables 78

INDEX TO STATISTICAL TABLES

TABLES		PAGES
I	Angier's Index of Shipping Freights	78
II	Earnings of Some Representative Cargo Lines	79
III	Earnings of Some Representative Passenger Lines	80
IV	Net Profit per Gross Ton of Oceanic S. S. Co	81
V	Value and Volume of British Overseas Trade	82
VI	Tonnage of Vessels Transitting the Suez Canal	83
VII	Fluctuations in the Price of a 7500-ton Steamer	84
VIII	Tonnage Under Construction in the United Kingdom at the End of Each Quarter	85
IX	Tonnage Launched in the United Kingdom During Each Year	86
X	Total World Tonnage at End of Each Year	86
XI	Chamber of Shipping Index of Ocean Freights	87
XII	Federal Reserve Board's Index of Ocean Freights	87
XIII	Entrances and Clearances at British Ports	88
XIV	Imports and Exports of United Kingdom in tons weight	89
XV	Laid-up Tonnage at British Ports	90
XVI	Entrances and Clearances of Vessels with Cargo at Ports of the United Kingdom, 1880–1920	91

INDEX TO CHARTS

CHART NO.		PAGES
I	Selected Indices of Shipping 1885–1924 (Original Data)	18
II	Shipping Freights and Steamship Profits (Relative Cycle)	26
III	Fluctuations in the Price of a 7500-ton Steamer (Original Data)	32
IV	Value and Volume of Overseas Trade of U. K. (Relative Index)	36
V	Tonnage Under Construction and Tonnage Launched in the U. K. (Original Data)	44
VI	Tonnage Under Construction in U. K. (Relative Derivative and Relative Integral Derivative Cycles)	45
VII	Tonnage Launched, U. K. and World (Original Data)	49
VIII	Tonnage Launched and Total World Tonnage (Relative Cycle)	51
IX	Selected Indices of Shipping 1918–1925 (Original Data)	55
X	Selected Indices of Shipping 1918–1925 (Relative Derivative Integral Cycles)	61
XI	Entrances and Clearances of Vessels at Ports of the U. K. (Original Data)	38
XII	Entrances and Clearances at Ports of U. K. (Relative Cycle)	39
XIII	Selected Indices of General Business Conditions 1921–6	70

I

Shipping and the Business Cycle

"O thou that art situate at the entry of the sea, who art a merchant for the peoples of many isles, Thus saith the Lord God: O Tyrus, thou hast said, I am of perfect beauty. Thy borders are in the midst of the seas, thy builders have perfected thy beauty. They have made all thy ship-boards of fir trees of Senir; they have taken cedars from Lebanon to make masts for thee. Of the oaks of Bashan have they made thine oars; the company of the Ashurites have made thy benches of ivory brought out of the isles of Chittim. Fine linen with broidered work from Egypt was that which thou spreadest forth to be thy sail."[1] Although the prophet Ezekiel may have called down the wrath of God upon the people that had insulted Jerusalem, there seems to be a note of envy in his lengthy description of these people of Tyre who by their maritime supremacy had been able to tax the riches of the whole world and to gather into their own markets the products of every known country. In many ways shipping has changed but little during the long centuries of recorded history. From the days of the Phoenicians, who are in many ways the founders of maritime commerce as we know it today, the function of shipping has always been to link up the various economic units which constitute the world, exchanging the products of one country against those of another, and enriching all by the diversity of products which were thus obtainable in the local markets. In the days of intense nationalism when trade and navigation were prerogatives hedged around by all the power of the State in an effort to exclude foreigners from the profits to be gained therefrom, it was the maritime nation which gained the greatest advantage from the development of maritime commerce. The envy of the Hebrew prophet at the rich markets and the prosperity of the Phoenicians, is very similar to the complaint of Sir Walter Raleigh that the

---

[1] Ezekiel XXVII, verses 2 et seq:

Dutch had engrossed the trade which rightfully belonged to the English because of the inferiority of the British ships, and both have very much in common with the diatribes hurled at the English by Commissioner W. W. Bates, a quarter of a century ago[2] because of the decadence of the American merchant marine which began early in the second half of the last century.

But if these complaints recognised the value and the importance of shipping, they also tended to obscure in a large measure its economic significance. Whether a national merchant marine is essential to the dignity and safety of a country is a question of politics—or perhaps of expediency—but from the economic point of view it is undeniable that civilisation today depends upon ocean transportation to a much greater extent than is generally realised. Modern civilisation is a product of machine industry, and the development of that industry has already created in Western Europe an area which depends upon the rest of the world for a large part of the food necessary to feed its growing population, as well as for an increasing proportion of those raw materials upon which its industries rely. Even a rich country like the United States is rapidly drifting in the same direction as is clearly evidenced by the continued decline during the past two decades in its exports of raw materials and foodstuffs. Moreover an industrial country produces commodities greatly in excess of the domestic demand; indeed it is by the sale of these manufactured goods that she is enabled to purchase the food and raw materials which she needs. But the countries which are large producers of food and raw materials are separated in many cases by thousands of miles of ocean highway from the industrial regions which absorb their surplus production and supply the manufactured goods,—the clothing and industrial equipment which they need. Shipping is the vehicle by which this exchange is effected, and for that reason shipping plays a vital part in the economic life of the world. Kipling in one of his shorter poems expresses very vividly the extent to which a country like England is dependent upon these navigators of the ocean highway:

---

[2] *The American Marine.*

"For the bread that you eat and the biscuits you nibble,
The sweets that you suck and the joints that you carve,
They are all of them brought you by all us big Steamers—
And if anyone hinders our coming, you'll starve."

If further proof of this dependence were required it would be found in the record of the hardship caused by the war in almost every country of the world, and of the conditions perilously near famine created in some places by the disorganisation of ocean transportation and the economic blockade.[3]

Ocean shipping, then, is an essential part of the industrial system; perhaps it is the most essential part because of the extent to which every other branch of industry relies upon it. By reason of this relationship with the manufacturing industry, and with the producers of food and raw material as well, shipping is affected indirectly by fluctuations that occur in either of these fields, and (with the railroads) it may be classed as one of the most sensitive of businesses. We should expect from this to find frequent and violent fluctuations in the shipping industry, and we shall not be disappointed. "The central fact of shipping finances," writes Professor Zimmerman,[4] "is that the earnings of shipping companies are unsteady in the highest degree. . . . The ship owner feels the pangs of adversity which affect the many industries and trades served by him: when he has good times they are very good—but his bad times are catastrophic." Nor is the matter one familiar only to the academic student of shipping: it is realised even more poignantly by the shipowner himself. "Ship-owning is a speculative business," writes Sir Ernest Glover,[5] one of the most prominent of British Shipowners. "Experience shows that trade runs in cycles; that two years of good trade are often followed by five years of depression, and that, on the average, the return which the capitalist obtains from shipping compares unfavorably with that which might be obtained from

---

[3] J. A. Salter: "Allied Shipping Control"; Consett & Daniel: "The Triumph of Unarmed Forces."
[4] "Ocean Shipping", p. 540.
[5] Brassey's Naval and Shipping Annual, 1924, p. 298.

investment in Consols. But the lure of high interest now and then will always be an attraction."

Despite this general recognition of the fluctuations in the shipping industry, there has never, to the knowledge of the writer, been an attempt made to determine the nature and extent of the Shipping Cycle, or even to establish clearly its nature and dimensions. Despite the closeness of the relationship which shipping bears to industry in general, shipping has almost always been excluded from the many studies that have been made of Business Cycles and it finds no place at all in the monumental work of Professor W. C. Mitchell in this field.[6] This exclusion has been very largely on account of the lack of adequate statistical data for the shipping industry. Statistics in the majority of cases are collected by governments or governmental agencies—but shipping is by its very nature international. Partly for this reason, and partly on account of the freedom from any close regulation which characterises the industry as a whole, the collection of statistics has been nobody's business. This general statement does not, however, apply to shipbuilding, since the records published by Lloyd's Register in this case are very detailed and exceedingly reliable. Of late years, moreover, the need for statistical information has come to be realised, and several very reliable indices are in process of compilation to which extended reference will later be made.

* * *

"The state of trade revolves apparently in an established cycle. First we find it in a state of quiescence, next improvement; growing confidence; prosperity; excitement; overtrading; convulsion; pressure; stagnation; distress; ending again in quiescence." This description of the business cycle given by Lord Overstone[7] almost a century ago has a dramatic flavour, but it demonstrates that a more or less clear conception of the cyclical nature of business fluctuations existed even at that period. For the past half century many studies have been made

---

[6] "Business Cycles" by W. C. Mitchell.

[7] "Reflections on the causes and consequences of the pressure on the money market, 1837."

of the nature and causes of these cyclical fluctuations, and, although there is a wide diversity of opinion as to the importance of the various causative factors, there is substantial harmony in the matter of the recognition of the phases that go to make up the complete cycle and of their relationship to one another.[8] Starting out with the revival, we must assume certain conditions which have been the result of the preceding depression, because it is necessary to break in at some point in the circle. At the commencement of the revival business firms are in a sound financial condition having written off bad debts and written down inflated capital. Inefficient firms have been weeded out by bankruptcy, and production is being carried on as efficiently and economically as possible owing to the fear of unemployment on the part of the worker and the desire of the employer to "make the best of a bad job." Both wages and prices of raw material have fallen, and there is a plenitude of liquid capital available. Such conditions as these are eminently suitable for the expansion of industry, and when for any reason there occurs an increase in the demand for goods, that increase is soon supplied. But an increase in the demand for goods once it has begun, tends to continue and cumulate, because "The whole concert of industrial operations is to be taken as a machine process, made up of interlocking detailed processes, rather than as a multiplicity of mechanical appliances each doing its particular work in severalty."[9] The increasing demand will therefore extend from one industry to another until it has affected the whole industrial system.

The revival will not immediately produce a rise in prices because the industrial equipment is not being used to anything like its full capacity. Competition for orders will remain keen, and it is possible that there may even be a slight temporary fall in the prices of some commodities. But with the gradual

---

[8] This description follows fairly closely that given in the report of the British Committee on Unemployment, which is the best brief and impartial summary known to the writer. A more complete discussion will be found in W. C. Mitchell's "Business Cycles," which also contains references to most of the other works in the same field.

[9] Veblen: "Theory of Business Enterprise," p. 7.

extension and cumulation of the process there will come a time when the existing plant is working at full capacity: any additional production will therefore necessitate increased capital expenditure. At this point prices will begin to rise, and the constructional trades will be among the first to experience any appreciable rise in prices because of the sharp increase in the demand for capital equipment. The price-rise will also be more pronounced in the wholesale than in the retail business—both of which differences we shall later find reflected in the individual case of the shipping industry. The revival has now passed into the period of growing prosperity. "Business men become more optimistic and proceed to make elaborate preparations for development."[10] The demand for capital increases rapidly as new concerns are started, and established firms extend their operations. An intense boom will be felt in the constructional trades by reason of the demand for capital products, and the result of this access of demand will be intensified by the fact that the constructional trades are normally concerned only with the repair and replacement of industrial equipment, together with the provision of such new equipment as is necessary to provide for the increasing trend of business. In a later chapter on shipbuilding, the results of this pressure will be demonstrated in more detail.

The prosperity enjoyed by the constructional trades will spread rapidly to other industries through two main channels, the prices of raw materials and the wages of labour. "The general demand for labour increases and all the employable unemployed are absorbed. Overtime is worked; old establishments, once regarded as obsolete, are pressed into service. The volume of production approaches the maximum of which society is capable."[11] This extension of activity causes heavy demands upon the capital which has been accumulated in banks and in the hands of investors during the period of depression. Even the initial stages of the revival increased the demand for working capital, and this was readily obtained by means of bank loans.

---

[10] *op. cit.*, p. 31.
[11] *op. cit.*, p. 32.

As the demands gradually increase in volume, however, the banks find themselves unable to cope with them, and business resorts to the capital market to float new issues of securities. Such issues are usually taken up with great rapidity. As the wave of optimism spreads, new concerns anticipate and prepare for, thus also accelerating and intensifying, a further rise in prices. They become eager buyers and place contracts which are frequently beyond their real needs, actual or prospective. Meanwhile, the producing capacity of the community having been reached, it becomes increasingly difficult to obtain the immediate delivery of goods ordered. Profits rise sharply, and dealers are eager to buy because they are confident of a profitable market.

But the boom is fostered by anticipations, and these are falsified by events. Just as the first evidences of a boom are usually found in the constructional trades, so these are likely to show the first evidences of the end of the boom. Extensions of business plant, cannot go on indefinitely, nor can the effective demand for consumers' goods continue to increase without limit. Moreover the cost of production has increased very considerably due to the decreased efficiency of labour and to the increased overhead charges of the concern. There comes a time when these increasing costs cannot be passed on to the consumer in the form of higher prices without decreasing the demand—and it is probable that the increase in capital goods will have increased the number of producers who are trying to market their products. As a result of all this there is likely to be a sudden and rapid fall in prices. Optimism now gives way to pessimism and a period of liquidation has set in. Operations will be cut down, inefficient concerns "weeded out" and we are then back again at the point from which we started.

* * *

Such briefly is the course of the business cycle, and the description has been given at some length in order to make clear the precise nature of the phenomenon that is being studied. Naturally the relative importance of the various phases will depend to a large extent upon the nature of the particular

industry that is being studied, and, in so far as it is possible to adapt a general conclusion to a specific problem, the above description of the business cycle has been so stated as to bring out those results which we should expect to characterise the fluctuations of the shipping industry. Shipping is essentially competitive: the rates at which goods are carried are determined almost entirely by the interaction of supply and demand. This has sometimes been disputed,[12] but even admitting the fact that liner rates are largely influenced by conference agreements it is clear that conference agreements can do no more than stabilise freights. Without doubt this fact is of great benefit to the shipper, but it does not very greatly modify the influence of competition, because if conference rates are fixed at too high a figure there is always the ubiquitous tramp[13] ready to step in and compete. Only so long as liner rates are reasonable will it be possible for a conference to hold a substantial portion of the trade on any route against tramp competition. The matter has been well summarised by Mr. L. K. Sherman,[14] Vice-President of W. R. Grace & Co.: "Ocean freights," said he, "are not a question of costs and distance. They are a question of competitive conditions. The field is wide open and you have to make rates that will get the business." According to another writer:[15] "Ocean freights vary between the minimum figure fixed by the direct cost of transportation and the maximum that the traffic will bear. Between these limits supply and demand prevail." It is, then, a reasonable assumption that any analysis of the shipping industry may ignore the question of monopolistic or governmental interference in the fixing of freights. The freights are a direct indication of the actual conditions at any given time. Moreover the shipbuilding industry is equally competitive, so that to this extent the problem of analysis is simplified.

---

[12] J. Russell Smith: "Influence of War on Shipping", p. 5, where it is maintained that shipping conferences regulate rates as closely "as the government regulates the price of postage stamps."

[13] While tramp vessels are less important from a numerical standpoint than they were before the war, they still constitute an important portion of the world's tonnage from the viewpoint of fixing rates.

[14] Hearings on the Subsidy Bill, 1922.

[15] Prof. L. Knowles: "Industrial and Commercial Revolutions", p. 291.

One preliminary factor remains to be mentioned, the question of statistics. Since records compiled upon a national basis are the only ones available, and since the records of different nations are seldom compiled on a comparable basis, it has been necessary to choose some single country in which there are fairly accurate records of shipping extending back over a period of years. The country that has been chosen for this study is the United Kingdom. This choice is justified by the maritime supremacy of the United Kingdom during the whole period under review. Admittedly that supremacy has been less since the close of the war, but not sufficiently so to vitiate the choice of British shipping as a fair sample. "Up to 1912 the United Kingdom carried half the sea-borne goods of the world, and in the twenty-five years before the war she built two-thirds of the new ships that were launched."[16] Moreover, at the outbreak of the war the British mercantile marine was the largest, the most up-to-date and the most efficient of all the merchant navies of the world. It comprised nearly one-half of the world's steam tonnage (12.4 m. out of 26.0 m. tons net) and was four times as large as that of its nearest and most formidable rival, Germany. An additional reason for the use of British statistics in preference to those of any other country lies in the fact that the statistics of other countries in many respects are even poorer than those of England.

[16] Knowles, *op. cit.*, p. 192.

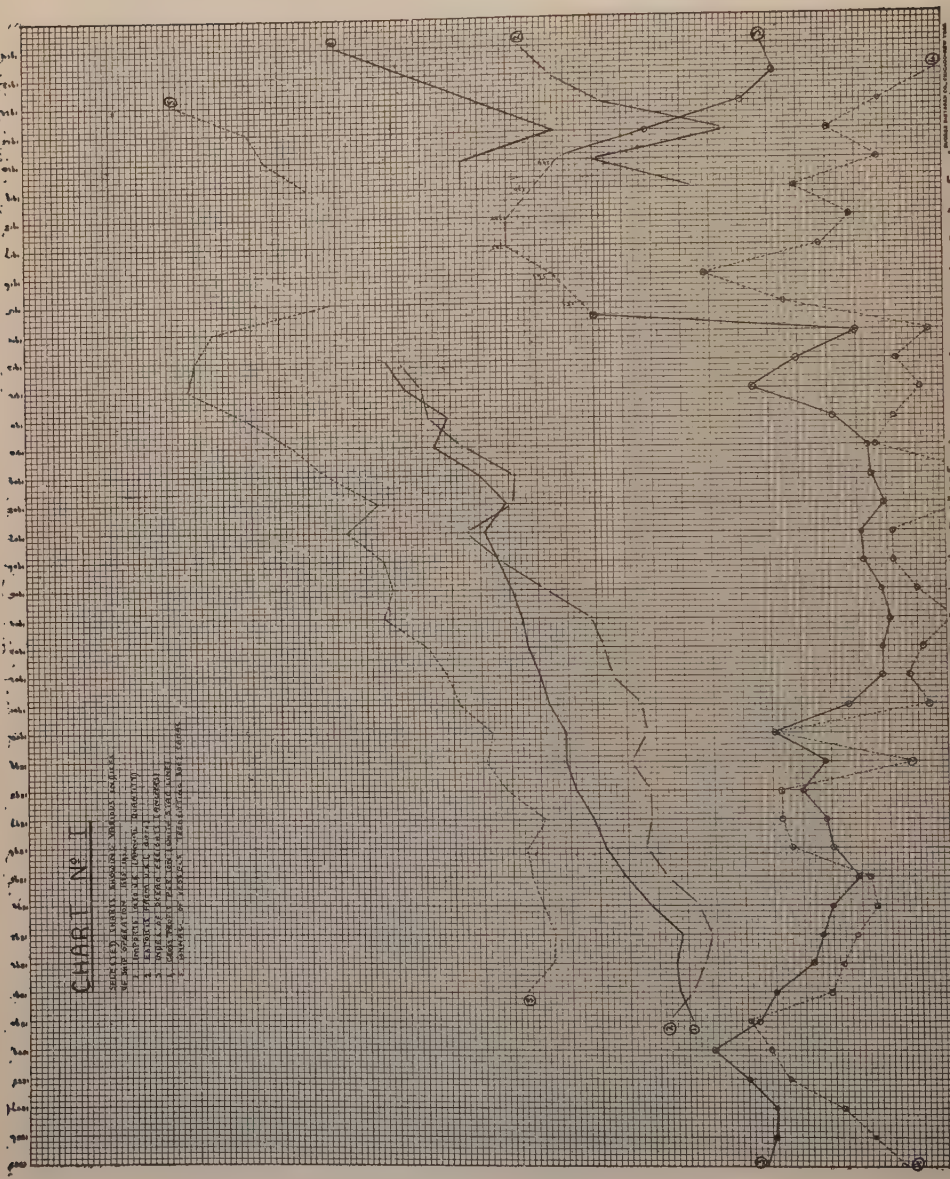


CHART Nº II

II

Thirty-five Years of Ship Operation 1890–1925

The chemist has many advantages over the student of economics in the matter of inductive research. When the chemist desires to satisfy himself as to the occurrence of a certain phenomenon, his course of action is comparatively clear. He will begin by a statement of those chemical equations which, when satisfactorily solved, will show him the results which should theoretically flow from a given experiment, and having satisfied himself as to the precise phenomenon which he wishes to observe the chemist will carry out the experiment within his laboratory under conditions as nearly perfect as human imperfection can make them. If his first experiment is not successful he can try it again as often as he desires, and should he find the conditions unsuited to his purpose, he can vary them at will. To the economist these refinements of detail are not accessible. Economic phenomena occur outside of a laboratory, and the time of their occurrence is not set by the student who wishes to observe the results. Sometimes they pass before their significance is fully realised, and almost invariably the records that are made are very inadequate for the purpose of inductive study. To this fact we have already alluded, as an obstacle to the study of shipping fluctuations and it is a very present one. But fortunately the avenue of deductive reasoning, made use of by the chemist, is also open to the economist. From the accumulated data, and the writings of students, we are enabled to form some clear idea of the character of a shipping cycle, if such should actually be found to exist, and while we cannot establish the existence of a shipping cycle by theoretical analogy with other industries, we know that shipping is itself a very important industry, closely linked up with the various parts of the industrial system. We know too that after allowance is made for certain timelags, the whole industrial system seems to move in a cycle, and the phases of that cycle are very similar as between one industry and another. We can therefore, by

deductive reasoning, state what may be described as an ideal shipping cycle—and then by a process of statistical analysis we can support or refute the existence of that cycle, or make the modifications necessary to harmonise with the facts discovered.

* * *

In a depression, such as has been experienced by shipping during the post-war period, conditions in the shipping industry are very similar to those in any other industry. During the period of prosperity there has been an excessive investment in fixed capital (ships), much of which is temporarily laid up or running with a poor load factor owing to the comparatively small market existing for shipping services. The efficiency of steamship operators, whether we speak of individual tramp owners or of large liner companies, will be at its highest level because only by the most efficient operation is the shipowner able to snatch even the smallest profit from the very low freights which characterise a period of depression. These freights are customarily lower, as compared with the freights during the period of prosperity, than the prices in almost any other industry; especially if we take the charter rates of tramp steamers as an index. The violence of this fluctuation is due entirely to the strongly competitive nature of the shipping industry, a factor which has been noticed in a previous chapter. This competitive factor, moreover, has a direct influence in the freight market to prevent any revival of the industry, because when a slight improvement in freights becomes apparent, owners immediately begin to put laid-up tonnage into a sea-going condition. If the cause of the rise in freights is not strong, the threat will immediately kill it—and even if the threat has no effect the force which is acting to raise freights will need to be very strong indeed to be able to carry all the laid-up tonnage along with it, and nevertheless succeed in raising freights to a level which is considered profitable to the industry as a whole. This is particularly true in a period like the present, when the abnormal intensity of the preceding boom led to an investment in fixed capital very much larger than that which usually characterises

a period of shipping prosperity. To find a comparable situation it is necessary to go back to the period which followed the South African Wars.

The state of depression will continue until the supply of tonnage has, through obsolescence and breaking-up, reached a figure proportionate to the demand in the then existing state of trade, or else a really strong revival in trade will so increase the demand for shipping services that all of the serviceable tonnage can find profitable employment. Not infrequently these two factors operate in conjunction. At first there will be no increase in shipping freights, because every additional voyage with cargo will make a more than proportionate addition to the profits of a ship that has previously been making voyages in ballast, or perhaps was laid-up altogether. Moreover there will linger in the minds of the shipowners the memory of the period of depression, and they will be chary of raising the rates which they charge, lest by so doing they should attract to their particular trade the competition of innumerable tramp-steamers eager to earn anything in excess of bare operating costs. If the revival in trade is strong enough, however, there will ultimately come a time when all of the serviceable shipping of the world has found employment.

At this point nationality no longer counts: during the depression and early revival the condition of the national mercantile marine may have seemed all-important to each maritime country, and at first traders may have exercised a preference for ships under their own flag. But shipping is essentially international, and a high rate of freight in any port will, if it be high enough, attract vessels of any nationality from every corner of the seven seas. When this point has been reached, and all the serviceable shipping of the world is profitably employed, freights will begin to rise very rapidly because traders who are anxious to move their goods in an endeavour to take full advantage of the current business prosperity, will find that with the temporary shortage of shipping *all* of the goods offering cannot be transported. They will therefore bid freights up very rapidly in order to ensure that their own goods be carried, and their anticipation of large profits out of the mercantile transaction in which the goods are involved

will lead them to be very liberal in their bidding. The rise in freights will not, however, be equally rapid in all branches of the shipping industry. Tramp charter rates will rise earliest and the extent of their fluctuations will be greater than any other freights, on account of the intense competition existing in this market. The policy of stability of rates adopted by the large steamship conferences will postpone somewhat the increase in liner freights and passenger fares, and it will greatly modify the extent of their fluctuation. This difference is in some respects comparable to the differences previously noticed between wholesale and retail prices in the case of the general business cycle, since the factors making for stability of liner rates are very similar to those which restrain the retail merchant from sudden and violent changes in the prices he charges for his goods

Meanwhile the high freights and the increased profits to the shipowners have led these latter to place new orders with the shipbuilders, bringing prosperity to the shipbuilding industry. A ship cannot be constructed overnight however: before the war the average time taken to build a vessel in British yards was twelve months,[1] and today it is perhaps 20–25 per cent longer. During this interval freights are bounding upwards and owners are continually placing new orders for construction in the hope that the vessels may be finished early enough to enable the owner to make a substantial profit before the break in freights occurs. Ultimately, however, new vessels are launched and the increased tonnage comes on to the market to compete for the available cargoes. If the trade boom is still in progress this tonnage may find employment without depressing rates, and this is usually the happy lot of the ships on which construction was commenced early in the period of prosperity. But the available tonnage continues to increase with each new vessel launched, and sooner or later the increase in the physical volume of trade comes to an end (for the financial volume of trade is of little interest to the shipowner). Then comes the commercial crisis and the sudden diminution in the volume of business. The increased shipping tonnage can no longer find enough cargo

[1] J. H. Jones: *Is Unemployment Inevitable?*—p. 287.

to keep all vessels profitably employed, and competition, especially between tramp vessels, becomes very fierce. Rates tumble down very much faster than they rose, and vessels will continue to compete as long as the loss during operation is less than the loss suffered from laying-up the vessel, because it is an expensive business to lay-up a ship and it also entails a heavy subsequent expense in refitting. As a result freights will rapidly fall to this point and vessels will be laid up which through age or poor construction are less able than their competitors to find profit in low rates. The depression has been reached, and we are at the point from which we started our description.

By the deductive method we have accomplished something similar to the result which the chemist achieves by the use of formulae: a theoretical condition has been established which enables us to concentrate our attention upon that phase of the experiment which we are most anxious to develop. Inductively, an analysis can be made of such recorded data as is available in the manner which will best demonstrate the existence of any cyclical movement within the data.[2] Beginning with ocean freights, the analysis can be extended to embrace the profits of shipping companies and the price of vessels—three factors which stand in very close relationship to one another. Any conclusions reached in this way can then be tested by means of the recorded figures of the volume of trade, of the movement of shipping and of construction, although the question of shipbuilding appears of sufficient importance to warrant a separate and somewhat more detailed treatment and will not therefore be taken up at this point.

The only authentic record of freight rates during the thirty years prior to the war—and indeed during the whole period prior to 1920—is that compiled by Messrs. Angier Bros. and published annually in the statistical number of *Fairplay*.[3] The figures represent a weighted average of freights for the whole of each year, and as a result they do not give a complete picture of those years in which freights were very active. Nevertheless

---

[2] For an explanation of the methods used see the Mathematical Appendix p. 73.

[3] And in *Fifty Years of Freights*, by E. A. V. Angier.

they may be taken as indicative of the general movements of the price of shipping services, and it will be helpful to review briefly the outstanding events in shipping history as shown in this index, and discussed in the annual statements of Messrs. Angier Bros. It will be seen that from 1884–1889 freights were good and did not show any serious fluctuation; indeed 1889 was considered a record year until the violent fluctuations of rates during the late war carried the record to a previously undreamed of height. From 1889 to 1895 freights fell to something like 60 per cent of their former level, but the engineers' strike of 1897 put a temporary stop to the construction of new shipping and freights began to rise on account of the artificial scarcity of tonnage. This tendency was intensified by the Spanish-American War of 1898 and the South African War of 1900, since wars invariably increase the demand for shipping tonnage to an abnormal extent. Rates rise very rapidly under this influence, but when the unusual demand terminates their fall is even more rapid, especially if additional tonnage has been constructed under the incentive of the high profits of the war period, which cannot immediately find profitable use when peace is restored. This was particularly the case in 1901, when freight rates fell by more than 25 per cent, leaving the market in so depressed a condition that rates remained at an unremunerative level until 1911. By this time conditions had so improved that the excessive tonnage had either been destroyed or absorbed into profitable use, and a condition of prosperity set in which continued on through 1912 and 1913, only to end in 1914 with a suddenness which was almost startling. The outbreak of war increased the depression in the shipping industry and many vessels were laid up, on account of the fear of war risks, which might otherwise have been kept in operation. By the end of 1914, however, it was realized that the war would continue for some time, and the increasing demands made upon shipping by the government coupled with the increase in demand which resulted from the fact that food and raw materials had often to be fetched half-way across the world instead of being obtained in a local European market, led to a very rapid and phenomenal rise in freight rates. This rapid increase in freights did not serve the interests of the

British Government and so in 1915 the famous Blue Book Rates were established, and during the rest of the war vessels were chartered by the government at these rates, although they were very soon incomparably below the market. For two years shipping companies continued to make large profits on the non-chartered vessels, and neutral powers were taking full advantage of the high market rates throughout the war, so that rates rose continuously until 1918 when the peak level reached was more than eight times as high as the average of 1913. This fact was not of any advantage to the British shipowner, however, because in 1917 the Government requisitioned all British tonnage and it was operated on government account until after the Armistice. This fact has an important effect on steamship profits which will be mentioned later.

Although freights fell continuously from 1918 to 1923 there was a short period of prosperity for shipping during 1919 on account of the fact that the heavy post-war demands kept all available tonnage in operation. Early in 1920, however, the market began to be clogged with idle tonnage and shipping entered upon a depression which has been more severe than any previously experienced. At this stage in the study of shipping conditions it would be unwise to prophesy, but if there is anything in historical analogy we may expect the depression to continue for some time. The conditions of ship operation after the South African War rendered ship operation unremunerative right up until 1911, as has been already noticed, and it is undeniable that the excess of shipping tonnage over the normal demand is very much greater now than it was in 1901.

An analytical examination of the data, however, gives a somewhat more complete picture. In Chart No. II an attempt has been made to eliminate the secular trend from the figures and to magnify the fluctuations. As a result we can trace a wave-like movement which gives indications of a large cyclical content, but is in part also influenced by sporadic movements. The peak years that stand out are 1889, 1900, 1906, 1912, 1916, and after the war, 1920, although in this last case it has been impossible to eliminate the very powerful movement of secular trend which was operating rather steeply in a negative direction.

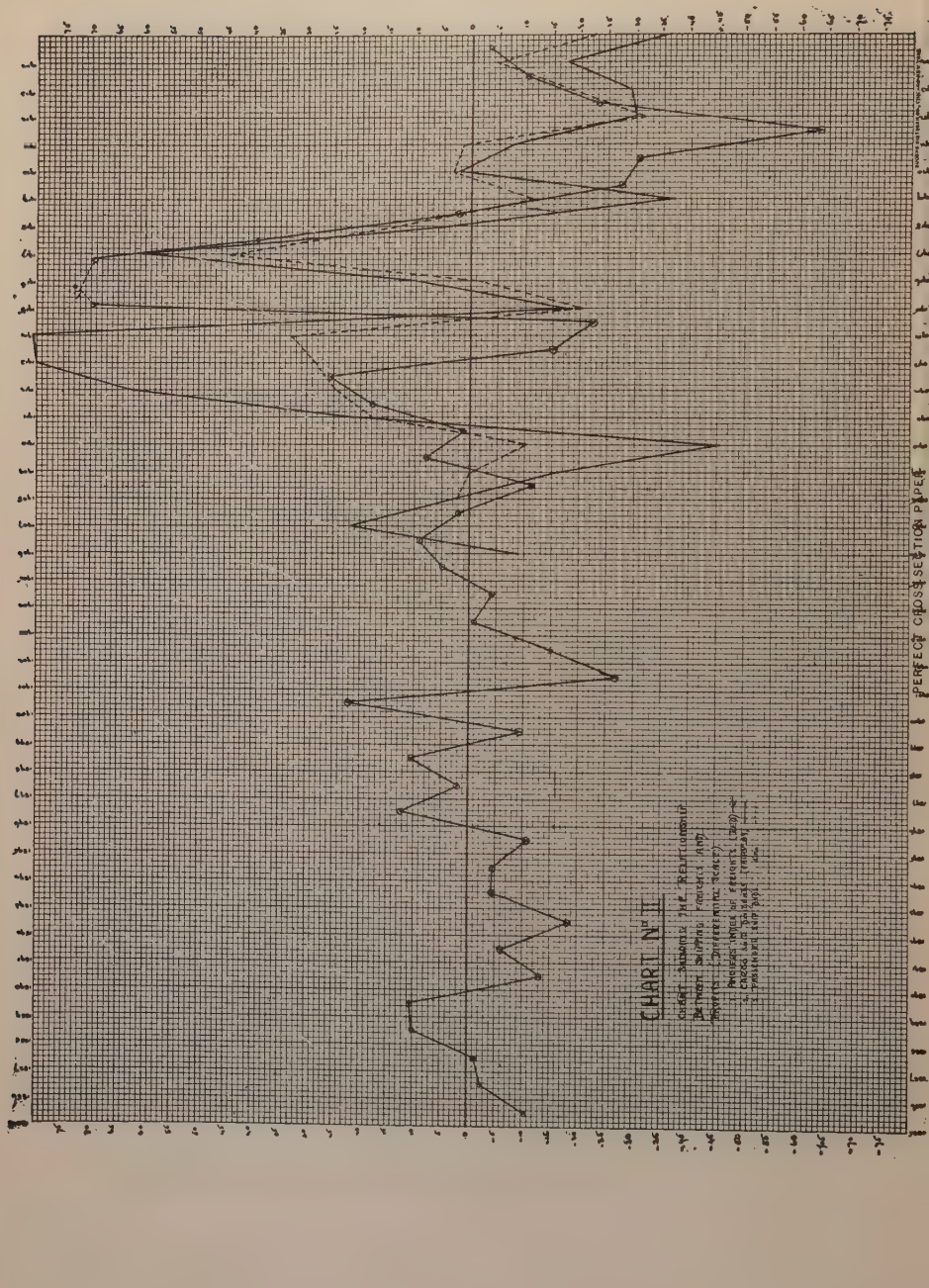


CHART N° II
PERFECT CROSS SECTION PAPER

These years, it will be noticed, coincide very closely with the years of general business prosperity which preceded the important commercial crises of this period, and it is of particular interest to notice a distinct peak occurring in 1906 despite the generally unprofitable nature of shipowning during the entire first decade of the present century. The peak, however, was one of diminished loss rather than of increased profit, and the subsequent depression was so serious that in 1908 international proposals were made for a general reduction of the shipping tonnage of the world.[4]

Unfortunately there are no available figures of the profits of steamship lines prior to 1904, and even at the present time the reticence of the large steamship companies on this matter together with the entire absence of any data for tramp shipping renders any real analysis difficult. The data contained in Tables II and III, upon which the chart was constructed, is reproduced from *Fairplay*, and a close inspection will reveal how little information they really contain. In the case of both Cargo and Passenger Lines the caption "Book Value of the Fleet" includes not only the book value of the steamers but also a host of stock exchange securities and other assets of a profitable nature. Without doubt these other assets constitute a large proportion of the capital investment of many steamship lines but it is impossible to estimate accurately their extent. If we assume that the 1,886,387 tons gross, recorded as owned by the Cargo lines represented, was worth in 1924 approximately £15 per ton[5] its value would have been less than 60 per cent of the £46,000,000 which appears as the book value of the assets and in the case of the passenger lines other assets are probably of even greater importance. These other assets are naturally a source of considerable profit to their owners, and as a result it is

---

[4] Similar proposals are being made in 1926, according to Press reports, although no definite action on a large scale has occurred.

[5] The liberality of this figure is demonstrated by the fact that the recent sales of the Stinnes' fleet were negotiated at an average figure of £9 per ton. (January, 1926.) It must however be borne in mind that data of this kind is largely a matter of scientific conjecture. Only in such rare instances as the one specified do these lines sell their tonnage, while figures as to the cost of construction are never published. An eminent authority has, however, estimated the value of such tonnage at £15–20 per ton, which while slightly above the value used in the text, does not invalidate the general conclusion.

practically impossible to determine the profit derived from ship operation. Perhaps therefore the loss is not as great as it seems when the companies operating passenger lines refuse to publish a figure of gross profits!

Nevertheless we may gain some little information from a study of these figures, especially from the figures of dividends paid, because, although these companies receive income from very many sources, their income from ship operation is notoriously the most variable. We may therefore assume with very little risk of error that the fluctuations in the rate of dividends paid to shareholders was largely accounted for by the fluctuations in the income received from the operation of vessels.

The dividend rate of the large passenger lines shows itself to have been very much more stable than that of the cargo-lines, a fact which we should have expected; first, on account of the fact that the fares of passenger lines are relatively more stable than the general level of freights, and, second, because the holdings of other assets are proportionately larger in the case of the passenger lines than in the case of those steamship companies which operate only cargo liners. Despite this difference in the extent of the fluctuations, however, we find the periodicity of the movements to be absolutely identical, the maximum dividends being paid by both groups of companies in the years 1906, 1913, 1917 and 1919–20 and the minimum dividends in 1909, 1914–15, and 1918. How does this compare with the figures of freights during the same period? In 1909 the minimum dividends have a time lag of from twelve to eighteen months after the lowest point reached by freights in the middle of 1908; this lag is found to repeat itself at the peak of prosperity of 1913, and again in 1917. In 1914, however, dividend rates followed freights down to the pit of depression within six months, a fact which was due in no small measure to the conservatism of the shipowners, who were anxious to provide reserves against whatever losses the war might have in store for them. In 1919, again, abnormal factors were in operation: freights tended continuously downwards from the high peak which was reached early in 1918, but it must be remembered that very few British companies were earning these peak rates

since the entire mercantile tonnage under the British flag was requisitioned and was being operated on government account. As these ships were released from government service during 1919 and 1920, two things happened: first of all the increase in tonnage brought rates down from the impossible level to which they had risen to a very much lower, but still highly profitable, figure; and, secondly, the increased amount of tonnage which each company was operating at market rates enabled it to earn a larger aggregate income from ship operation. It is to this abnormal situation that we can attribute the fact that dividends in 1920 were at a higher rate than in 1919, although freights declined continuously from 1918 until 1923. It seems therefore that we may reasonably in normal times allow for a time lag of from twelve to eighteen months between the movements of freights and the resultant variations in the profits of steamship companies, which is an entirely natural relationship in view of the circumstances of the case.

Before we leave these tables,[6] it will be of interest to look for a few moments at the two columns in the table of cargo-boat earnings which show us the depreciation actually written off, and the depreciation calculated at 5 per cent (20 years being considered a normal life for a ship). In the years which we previously noted as years of depression, viz.: 1909, 1914, 1918, and 1922, we find three cases in which an acute depression is clearly evidenced by the inability to provide adequately for depreciation. From 1904–11, in 1918 and from 1922–24 we find that the companies set aside for depreciation sums less than 5 per cent, which is a very striking testimony to the acuteness of depression in the shipping industry when we remember that these are companies selected for their soundness, all weaklings being rigorously excluded. In 1914 conditions were abnormal and profits were put into reserves instead of being paid away as dividends. On the other hand in the periods of prosperity we find that sums are set aside for depreciation very much in excess of the conventional 5 per cent; this is notably the case in 1913, 1916–17 and to some extent in 1920. In 1906–7 no adequate,

[6] Tables II and III; pp. 79, 80.

let alone excessive, provision was made for depreciation, the shipowners preferring to distribute their additional income in the form of slightly increased dividends to their long-suffering shareholders.

It would have been of great assistance in this analysis of the relationship between freights and profits if information as to the costs of steamship operation had been available, since it is known from the general studies of the business cycle that towards the end of the period of prosperity costs tend to encroach very considerably upon profits so that increased prices do not result in anything like a comparable increase in profits to business enterprise. Unfortunately it has not been possible to obtain any figures of costs of operation, excepting in the case of those companies which later fell into a receivership, and since these would not be at all comparable to the figures which have been used for profits it has been thought best to exclude them. Despite this fact the mathematical use of a relative derivative method gives us a definite indication of the fact that the maximum profits of steamship companies followed the years not of the absolute maxima but of the relative maxima in freights in those cases where these points do not coincide. The same is true of profits during the periods of depression. Thus although the actual maximum freight rates are found in 1907, the relative maximum occurs in 1906 and it is the movement of the relative figure which the dividend curve follows most closely. Again during the post-war period although the absolute figure for freights continued downwards until the end of 1923 the relative nadir was reached in 1921 and was followed rapidly by a change in the dividend curve. Moreover the absolute increases in the rate of dividend payments in the case of both Cargo and Passenger Lines shows a distinct tendency to diminish as the peak of the cycle is reached, so that we may reasonably infer from our general knowledge of cyclical movements that costs are tending to absorb an increasing proportion of the gross income.

A rather interesting series of figures obtained from the Oceanic Steam Navigation Company throws some additional light on the problem. The figures, which are presented in Table IV, show the fluctuations in the net profit per gross ton of vessels

actually operated, during each year of the period from 1885–1923, *i.e.*, the net profit from all sources has been divided in each year by the actual tonnage operated by the company. Beginning with the peak of 1890 we find a very sharp decrease in profits which continued more slowly until the nadir of 1894 was reached, and then began to rise (a year before the increase in freight rates) to the peak of 1900, with a sharp drop in 1899 due to the sharp decline in freights in the middle of that year which we noted as a sporadic movement.[7] It will be noted that after 1900 profits did not again rise above the average for the whole period until 1914–15, although distinct peaks are evident in 1907 and 1910. The depressions occurring in 1912–13 and 1920, at first sight rather hard to account for, become clear on closer analysis. The first of these years was the peak of a long continued period of shipping prosperity during which heavy construction programmes had been embarked upon by this, and most other, large shipping companies. In 1913 these vessels had been completed and so would swell the figure for aggregate gross tonnage by which the net profits were divided to obtain this index. Moreover if our assumption is correct, operating expenses would have encroached heavily upon income in this year which marked the peak of the boom, so that the figure for net profits may also have shown some diminution. In 1920 a similar increase in gross tonnage had resulted from the war-time programme of ship-building and the factor of increasing costs was also operative. It will be noted also that in all of the pre-war shipping booms, *i.e.*, 1900, 1907 and 1912–13 there was a distinct tendency for this figure of net profit per gross ton to show a diminishing rate of increase during the later years of the period of prosperity, while in the last case there even occurred an actual decrease in the index, and in 1894, 1904 and 1913, the index of profits started upwards before the price of shipping services had reached its lowest point.

There is evidence, therefore, for the assumption that the relationship between prices and net profits in the shipping

---

[7] At this time the company was purchased by the Morgan interests to act as a component part of the International Mercantile Marine.

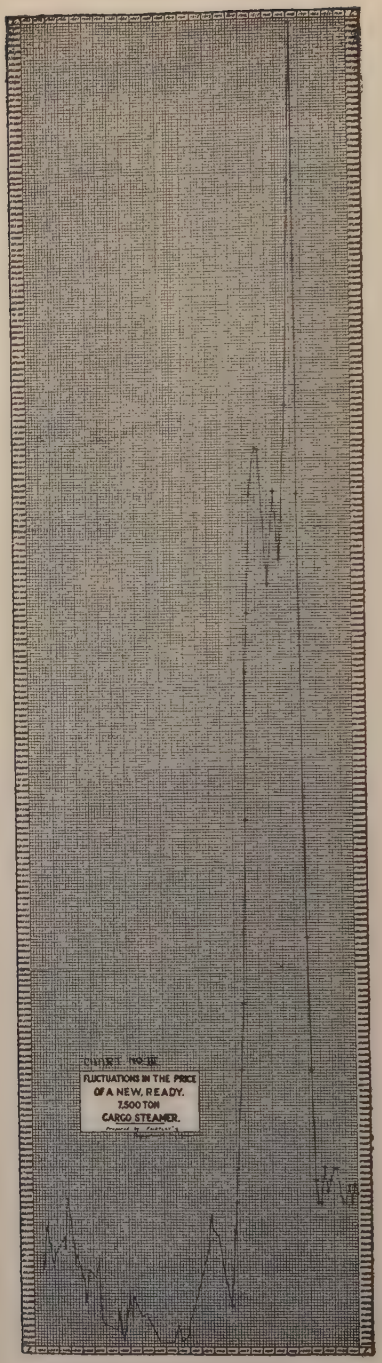


CHART TWO-III.
FLUCTUATIONS IN THE PRICE
OF A NEW, READY.
7,500 TON
CARGO STEAMER.

industry is dependent upon cyclical fluctuations in a similar way to that relationship in any other industry, although it should be noted in parenthesis that when the profits are related to capitalisation in the form of the rate of dividend payments the maxima and minima invariably follow the curve of freights with a time lag of a little more than a year. The reason for this discrepancy between the figure of net profits per gross ton in our sample case, and the general figure of the rate of dividends paid is explained by the abnormally low level to which profits fall during the pit of depression and by the application of early increases in profits to the repairing of the depleted reserves.

The next step in the analysis is to tie up the fluctuations in the price of vessels with these variations of freights and profits. In customary practice the price of a vessel is expressed in terms of pounds sterling (or dollars) per ton of the vessel's gross tonnage, but there is an infinite variety of ships running all the way from a simple single-deck tramp steamer of very plain specifications up to an elaborate passenger liner fitted with every possible contrivance which human ingenuity can devise to promote safety or comfort, and in addition there are a host of specialised vessels of all types of which the oil tanker is the best known example. Some single type of vessel must therefore be chosen as a representative expression of the movements in price, on the assumption that the prices of the more elaborate and more highly specialised types of shipping will vary by proportionate amounts, and since the tramp vessel constituted some 60 per cent of the total tonnage of shipping under the British flag prior to the war we can use the price of an average tramp steamer, bearing in mind, however, the fact that the average cargo vessel of today is vastly improved from that in use before the war—and consequently more expensive than the standard vessel chosen. Each year *Fairplay* publishes the price of a 7,500 ton new, ready cargo-steamer, and this figure will be used here. The price, it will be noted, is not the contract price of tonnage about to be constructed, but the sum fetched by the sale at public auction of a new vessel that is in all respects ready for immediate use. For this reason the price will respond very much more rapidly to changes in the demand for ships, but the

contract price for new construction generally follows very closely and the relationship between the two figures is very close indeed in most of the cases in which the writer has obtained data from the shipbuilding companies with which comparison could be made.

In this case, sporadic influences are noticeably more important than in the case of freights or profits, a fact which may be accounted for partly by the fact that the present figures are not averages but represent the highest and lowest prices actually obtained at sales in any given year, and partly because a purely temporary and fortuitous demand may be imperative enough to warrant the purchase of a single vessel at a price somewhat above the market, and may still be of too small an importance to affect the general figures either of average freight rates or of the general level of profits. Despite these sporadic influences, we find the price rising steadily to a level of £60,600 in the last quarter of 1900, and falling rapidly to a level of £36,500 in the middle of 1905, in spite of a temporary upward movement in 1903. It then rose sharply to a peak of £44,500 in the last quarter of 1905 and the first of 1906 but the upward movement was of very short duration and was succeeded by a period of decline which reached a nadir of £36,000 in 1908–9. The knowledge of the excessive amount of shipping available during the first decade of the present century would have led us to expect such a movement, and even the temporary advance in the last half of 1905 was caused, not by a scarcity of shipping tonnage, but by a scarcity of tonnage that was available for immediate service. As soon as a portion of the laid-up tonnage was reconditioned the price dropped rapidly until it ultimately touched, in 1908, a lower level than at any other time during the period under review.

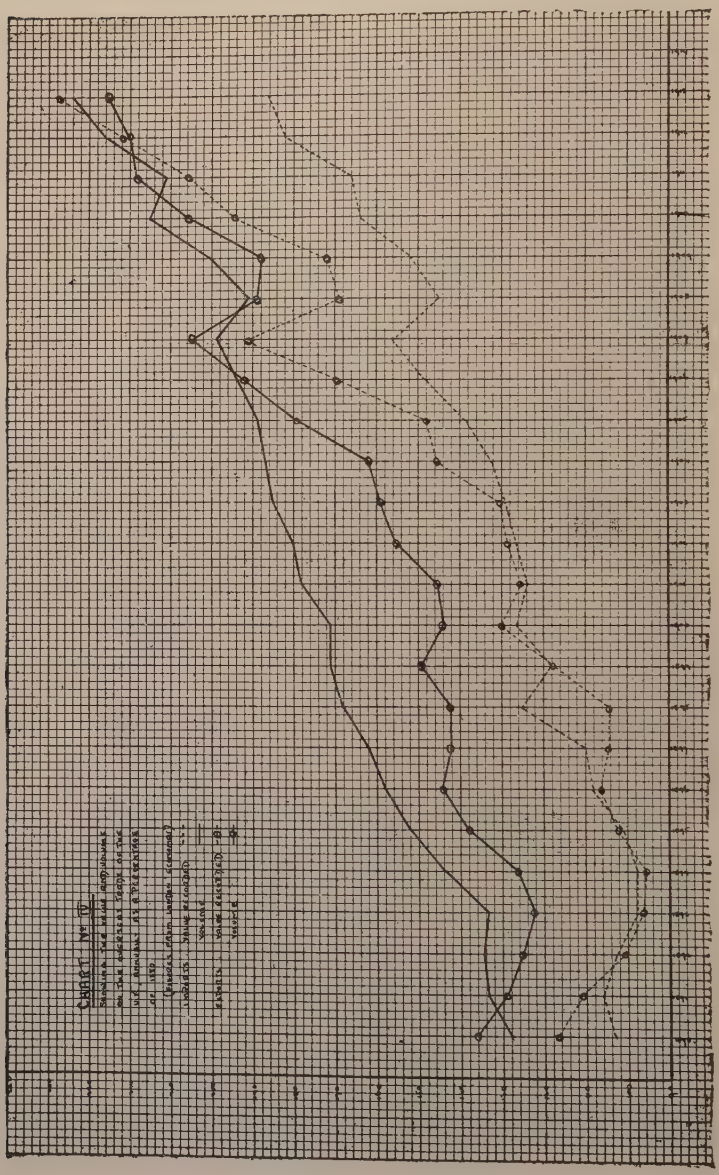
From 1908 right up to the last quarter of 1912 there was a steady increase in price until a figure of £58,000 was reached, only to be followed by a rapid fall to £42,500 at the beginning of the third quarter of 1914. During the whole of the pre-war period, therefore, the relationship between freight rates and the price of shipping was very close indeed, the data moving in the same direction and reaching its peaks and nadirs at almost

identical points. During the war the price rose rapidly to a new record high level of £177,500 in the first quarter of 1917, after which it declined slightly during the period of complete governmental control, only to rise with phenomenal rapidity as soon as that control was removed to the undreamed of figure of £258,750 at the end of the first quarter of 1920! This movement differs very considerably from the movement of freight rates which reached their zenith in 1918 and declined steadily thereafter with only a slight recovery in 1920—but the difference is to be accounted for by the fact that the freight index is the record of a market almost free from any vestige of control, in which ships flying neutral flags reaped a rich harvest. As soon as British shipowners were allowed to operate their vessels on their own account, there was an intense demand for new tonnage ready for immediate service with which to replace the tonnage which had been lost on account of war risks, and so to enable the shipowners to take advantage of the abnormal demand for shipping services which characterised the eighteen months immediately following the Armistice.

From the peak of 1920 prices fell precipitously to £60,000 in the third quarter of 1921—a drop of more than 75 per cent in fifteen months! This low level has been maintained, with slight fluctuations, until the present time.

Ocean freights, steamship profits and the price of vessels therefore all appear to indicate that shipping was subject to a distinctly cyclical fluctuation. In all cases we find the peaks of prosperity in 1900, 1906–7, and 1912–13—and if there appears to be a slight discrepancy between the three sets of figures during the period of the war it can be accounted for by the policy of governmental control which, while it did not remove the cycle, certainly altered its dimensions and rendered its measurement difficult by reason of the inaccuracy of any data based upon open market figures at a time when British shipping was entirely under government control and was remunerated at Blue Book Rates.

Corroboration of this opinion is to be found in those figures which give us an indication of the demand for shipping tonnage. Unfortunately these figures are all too rare, because foreign trade statistics are collected only by governmental agencies,



and governments have been concerned much more with the financial than with the physical volume of trade. From a shipping viewpoint figures of the financial volume of trade are worse than useless, because they are deceptive, and so in Table V an effort has been made to correct these figures for price fluctuation in order to obtain an approximate measure of the physical volume of trade. The results have not been entirely satisfactory on account of the large seasonal and secular movement, to say nothing of the mathematical inaccuracies which are possible in such a method. Nevertheless the figures of both imports and exports do indicate an increased volume of trade in 1899, 1907 and 1913. Similarly the figures of the aggregate gross tonnage of vessels of all nations transitting the Suez Canal,[8] which may be taken as a fairly accurate indicator of shipping conditions, show distinct peaks in 1907 and 1912.

Fortunately for our purpose, however, there is available a very complete and accurate record of the entrances and clearances of vessels with cargo at ports of the United Kingdom[9] throughout the whole period of this analysis, although we must admit the difficulty arising from the fact that the load factor may vary. Entrances and Clearances "with cargo" does not mean with a *full* cargo. This, however, does not in any way vitiate the conclusions drawn from the figures since it would tend to minimise rather than exaggerate the cyclical fluctuation. A representation of the original data in the form of a chart[10] shows little more than the fact that there was a regular and continuous increase in the total volume of shipping carrying goods to and from British ports during the whole period from 1880 right up to the outbreak of the war in Europe. Subsequent to 1914 the figures are of very little use because of the fact that all vessels under charter to the government for war purposes are excluded—and it has already been pointed out that this automatically excludes a very large proportion of the total British mercantile marine.

---

[8] Table VI.
[9] Table XVI.
[10] Chart No. XI.

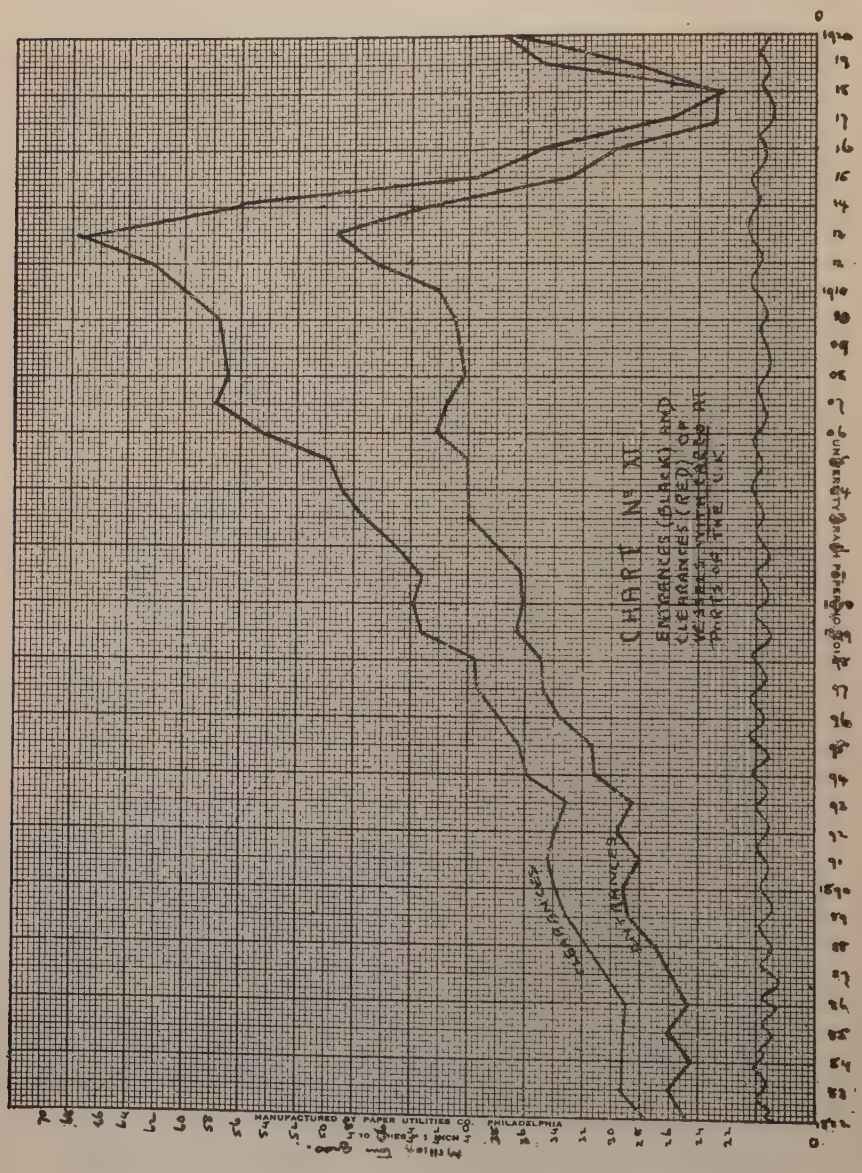


CHART Nº XI
ENTRANCES (BLACK) AND
CLEARANCES (RED) OF
VESSELS WITH CARGO AT
PORTS OF THE U.K.
ENTRANCES
CLEARANCES
MANUFACTURED BY PAPER UTILITIES CO. PHILADELPHIA

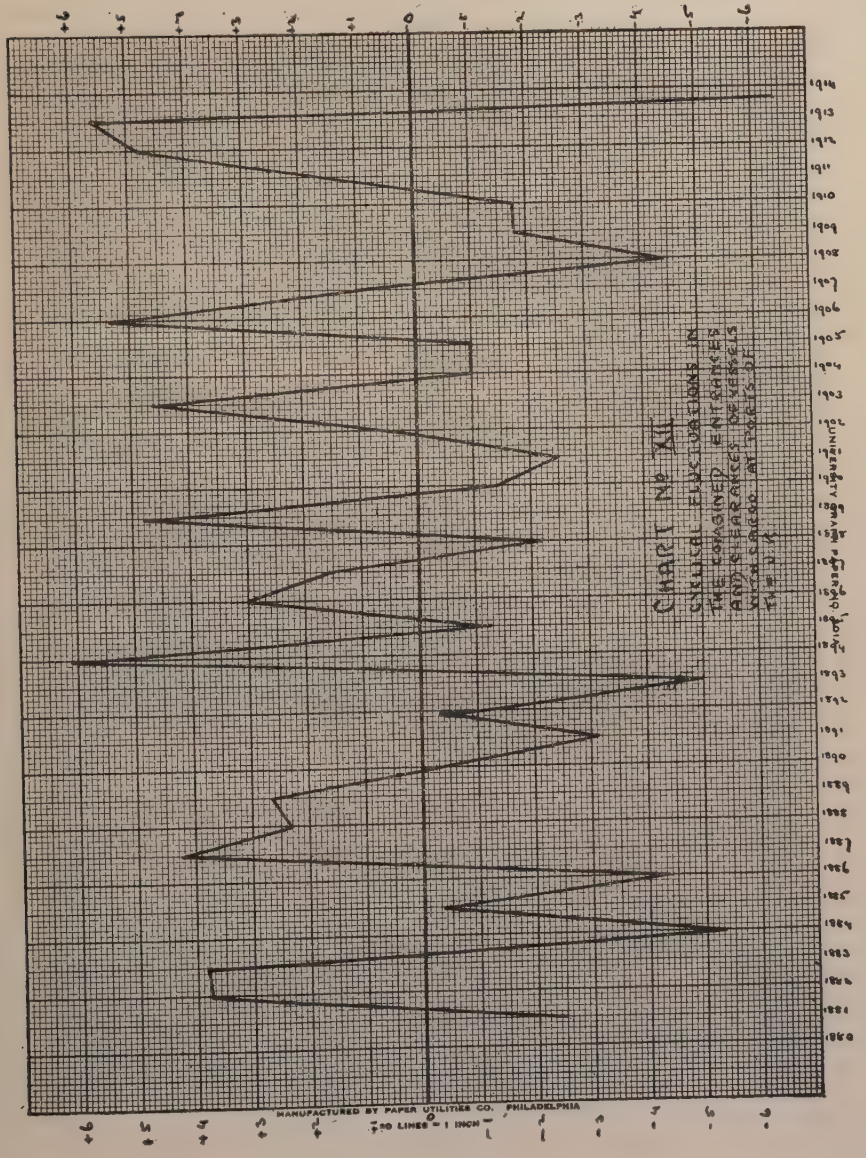


CHART Nº XII
CYCLICAL FLUCTUATIONS IN THE TONNAGE ENTERED AND CLEARED OF VESSELS LOADED AT PORTS OF THE U.K.
MANUFACTURED BY PAPER UTILITIES CO. PHILADELPHIA
100 LINES = 1 INCH

In Chart No. XII, the same figures from 1880–1914 are shown in relative form after the strong secular trend has been eliminated. The chart reinforces very clearly the picture that has already been drawn of the cyclical fluctuations in shipping, showing definite peaks once again in 1883–4, 1887–9, 1899, 1906 and 1912–13 which coincide very closely with those shown by the movement of freight rates. An interesting point, that will receive more detailed discussion in the analysis of shipbuilding, is the existence of peaks in 1894–6, 1903 and in 1909–10. Minor peaks at this time were evident in the index of freight rates and also in the price of vessels, which leads to the opinion that there may exist in the shipping industry a very definite intermediate cycle.

Apart from the figures of entrances and clearances at British ports, the figures of the volume of trade and of the movement of shipping are admittedly weak. For this reason the argument has been based upon the financial indices, and the introduction of the other figures has been made to lend support to the evidence which has been given of the existence of a definite cyclical fluctuation in shipping during the period under review. Proceeding from this analysis, we shall now examine the figures of shipbuilding to see if they will reveal anything, or add to the weight of the conclusions which may be drawn from the history of ship operation.

III

The Shipbuilding Industry

"With the possible exception of tin-plate manufacture (1891–96) I know of no important British industry which has suffered a depression so severe and at the same time so prolonged as that now suffered by the shipbuilding industry. . . . Moreover, this industry, before the War, was subject to extreme fluctuations, whether these be measured by output or prices."

It is with these words that Professor J. H. Jones begins a study[1] of the British shipbuilding industry written in May, 1924, and his words are amply warranted by the statistical evidence which is available. The swing of the pendulum has probably been more violent in the case of shipbuilding, than in the case of any other industry connected with international trade, and the British shipyards have borne the greater part of the burden by reason of their supremacy[2] in the field of ship-construction.

The reasons for the violence of these fluctuations are to be found in the nature of the industry itself, which is characterised by three distinctive features. First of all, the unit product in the shipbuilding industry is both large and expensive. Before the War the minimum period of time required for the construction of a cargo steamer of about 7,500 tons gross, without "trimmings" of any kind, was seven months and in the case of the larger and more elaborate types of vessels this period was frequently doubled or tripled, so that on an average the period of construction may be taken to have been twelve months. At the present time there are several indications that the length of this period has been increased rather than diminished. It is clear, therefore, that there is in the shipbuilding industry no

---

[1] *Is Unemployment Inevitable*—pp. 284, 288.

[2] The following table shows the percentage of the world's gross tonnage launched from the shipyards of the U. K. during the years 1892–1914:

1892–94—81.6 per cent
1895–99—72.9 per cent
1900–04—59.9 per cent
1905–09—61.0 per cent
1909–14—61.9 per cent

continuity of supply such as is found in the cotton industry or in the iron and steel trades. A short delay in the placing of a ship on the stocks means unemployment of both capital equipment and labour on a very large scale. Secondly, the product and the building plant are both highly specialized, and a temporary loss of orders in one direction cannot, as in most other industries, be neutralised by a successful search for orders in some other directions.

The third feature, which emphasises the importance of the first two, is present in most constructional trades, though it is perhaps more pronounced in shipbuilding than in any of the others. It has already been stated that the life of a ship is approximately twenty years. Let us assume then, that ocean traffic over a given period is constant and is sufficient to maintain 1000 ships in full employment, it follows that an annual output of 50 ships will be required to maintain the fleet in a state of efficiency. Suppose, next, that traffic in one year increases five per cent, the immediate demand for ships will be increased to 100 (*i.e.*, 50 ships for replacement and 50 ships to meet the increased traffic); and a further increase of five per cent in traffic during the following year would mean a total demand for 150 ships. If the traffic then ceased to advance, but remained at the higher level, the demand for new additional ships would disappear, and the requirements for replacement would amount to 55 ships a year. Thus a depression may—and frequently does—occur in shipbuilding even when traffic requirements do not diminish. Professor J. Maurice Clark, referring to the construction trades in general,[3] expresses this characteristic very concisely:

"The demand for equipment may decrease," he writes, "even though the demand for the finished product is still growing. The total demand for equipment tends therefore to vary more sharply than the demand for finished products and the maximum and minimum points in the demand for equipment tend to precede the maximum and minimum points in the demand for the finished product, the effect being that the change may appear to precede its own cause."

---

[3] *Studies in the Economics of Overhead Costs*, p. 388.

Thus Kirkaldy[4] points out that in 1912

"shipbuilding had already proved to be unprofitable, while prosperity still characterised the operation of ships"—

although he appears to treat the matter as a condition peculiar to the period of which he is writing, without realising that it is a thing which will tend to repeat itself with every cycle.

In practice, however, the fluctuations are not as violent as is suggested in the above illustrative case. During a shipping boom ships are retained in service which otherwise would be broken up. Liner companies also generally act independently of the immediate situation and lay out a programme of construction which looks very far ahead. Shipbuilders, when considering whether or not they should extend by preparing new berths and slips, or building new yards, are influenced less by the momentary rush or absence of orders than by the probable trend of trade. But cargo steamship owners are often strongly influenced by actual and immediately prospective freight rates, and when these are high and cargo-space is insufficient to meet the demand, they place orders for new ships and create a boom in the shipyards, which is frequently intensified by the offer of a premium for early delivery. Then orders fall away quickly (not because traffic has diminished but because the probable increase has been met), and in due course, when those vessels already on the stocks have been launched, depression sets in, and continues until the older ships are scrapped.

The analysis of the fluctuations in the shipbuilding industry is greatly facilitated by the fact that the available data is both adequate and accurate. Lloyd's Register of Shipping publishes at the end of each quarter a statement of the tonnage under construction in the shipyards of the United Kingdom, and in its annual statement gives a figure for the tonnage launched during the previous twelve months. These figures, together with the records of the fluctuations in the price of vessels to which some reference has already been made, constitute a very complete

[4] *History of British Shipping*, p. 590.

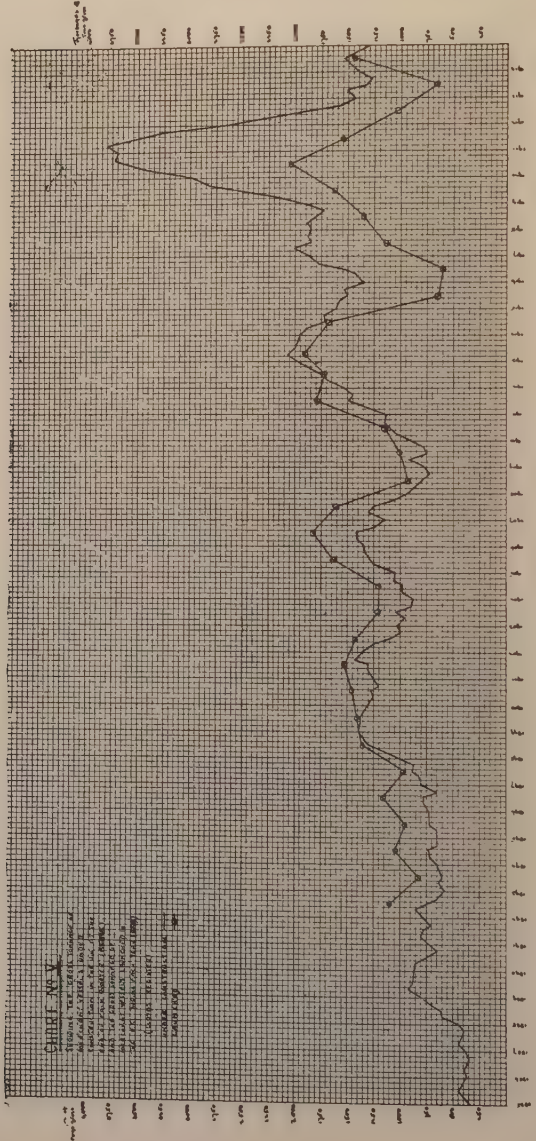


CHART N° VI
PERFECT CROSS SECTION PAPER

record of shipbuilding, and it is possible in this case to write with very much greater precision than was possible in the case of ship operation, where there is no institution corresponding to Lloyds' which might concern itself with the task of compiling accurate statistical information of a kind which would be of service to the student of shipping affairs.

The figures showing tonnage under construction in the shipyards of the United Kingdom at the end of each quarter, which are given in Table VIII and charted graphically on Chart V, show all tonnage that is actually on the stocks at the date on which the record is made. Thus if a contract is placed for the construction of a passenger liner of 25,000 tons gross, which it is estimated, will take two years to build, the gross figure of 25,000 tons will appear in the construction figures for every quarter during these two years. Continuing the hypothesis, let us assume that, owing to the intensity of a shipping depression which follows soon after the placing of the order, work is temporarily suspended on the vessel for twelve months. Despite this fact the gross tonnage will still be included in the quaterly, figures of tonnage under construction.[5] This fact will naturally operate to smooth out the fluctuations in the published figures, so that they will show a less violent cyclical movement than that to which the industry is subject—yet even when all this has been said the data available for the shipbuilding industry show a cyclical fluctuation which is clearer and more violent than that shown by any of the other indices of shipping.

To demonstrate this fact a relative derivative cycle[6] was first calculated, and is plotted at the top of Chart No. VI. The relative derivative method of handling a series of data is designed to magnify every fluctuation of a cyclical or sporadic nature, after the secular trend and seasonal variation have been eliminated. But because of the high degree to which sporadic influences are magnified they sometimes tend to obscure the truly cyclical fluctuation, and for this reason a relative integral derivative cycle[7] has also been calculated in which the data is

[5] Figures of tonnage on which work has been suspended have been shown separately of late years.

[6] and [7] See Mathematical Appendix.

integrated over five quarters before the derivative is taken. This does not in any way modify the nature of the cyclical fluctuation, but it does diminish the importance of a purely temporary and sporadic influence since the ordinates of data have been increased approximately five times in size. The relative integral derivative cycle has been plotted beneath the relative derivative cycle on Chart No. VI and the close relationship between the fluctuations in the two cases is very evident. Subsequent analysis will therefore be based entirely upon the relative integral derivative cycle because of the fact that the cyclical element is here magnified and all other elements are eliminated as completely as possible.

As might have been anticipated from what has already been said of the nature of the shipbuilding industry, the figures show peaks in the fourth quarter of 1888, the third quarter of 1898, the second quarter of 1905, the third quarter of 1910, the second quarter of 1917 and the fourth quarter of 1919—the decline in the shipbuilding industry in each of these cases anticipating the decline in freight rates by from twelve to eighteen months. But this does not tell the whole story, for the analysis reveals the existence of smaller intermediate cycles, similar to those already observed, which reach their zeniths in 1892–4, 1902 and 1924—years which in every case were characterised by comparatively low freight rates. How is this apparent anomaly to be accounted for?

During the early period of a depression, when freights are declining with phenomenal rapidity, we have noticed that shipping companies do not provide adequately for the depreciation of their fleet. In an effort to prevent too rapid a decline in the rate of dividends paid to their shareholders they are willing to ignore almost entirely the need for replacement of the older vessels which they own—especially when the depression means that some of these ships will in all probability have to be laid-up for lack of work. No new orders will be placed with the shipyards towards the end of the period of prosperity, for reasons that have already been presented, and certainly no orders will be placed during the early part of the depression. But there are several factors present in this situation which make for a

comparatively early revival in the shipbuilding industry. First of all the obsolete ships, which were kept in service during the period of prosperity, will find that their high cost of operation renders it impossible for them to carry cargoes profitably at the reduced freights which are offered, and since laying-up involves an additional expense to the shipowner, they will be sent to the ship-breaker as soon as they are no longer able to earn a profit. This decreases somewhat the available supply of shipping, and renders possible the assumption that the remaining tonnage will be unable to cope with the demand when trade enters upon a period of revival. Secondly we have already noted the fact that liner companies normally lay out a construction programme which looks some distance into the future. They will therefore tend to place orders for such new tonnage as they anticipate will be needed when the revival comes, at the time when the depression has carried the cost of building to a very low figure. Finally, if neither of these causes should operate with sufficient promptitude to bring new orders before those already under way are completed, the shipbuilders will often start to construct vessels on speculations in an effort to maintain at least a nucleus of labour and to keep their equipment in operation. For the same reason they will be willing to undertake the construction of new tonnage at prices which do little more than cover the costs of raw materials and labour—a fact which acts as an additional incentive to those shipowners who might be led to construct new vessels for either of the reasons previously given.

Freights, however, do not revive as rapidly as this, partly because of the general depression in trade and partly because the existing supply of shipping tonnage, despite the scrapping of the obsolete vessels, remains in excess of the immediate demand. The completion of the new vessels, constructed for reasons already mentioned, therefore serves to increase the depression, and after a very short boom the shipyards tend to enter again on a period of depression from which they do not emerge until some time after the revival in freight rates has begun—a fact which is to be expected, since the vessels constructed during the depression of the freight-market are sufficient to meet with any moderate increase in the traffic to be handled.

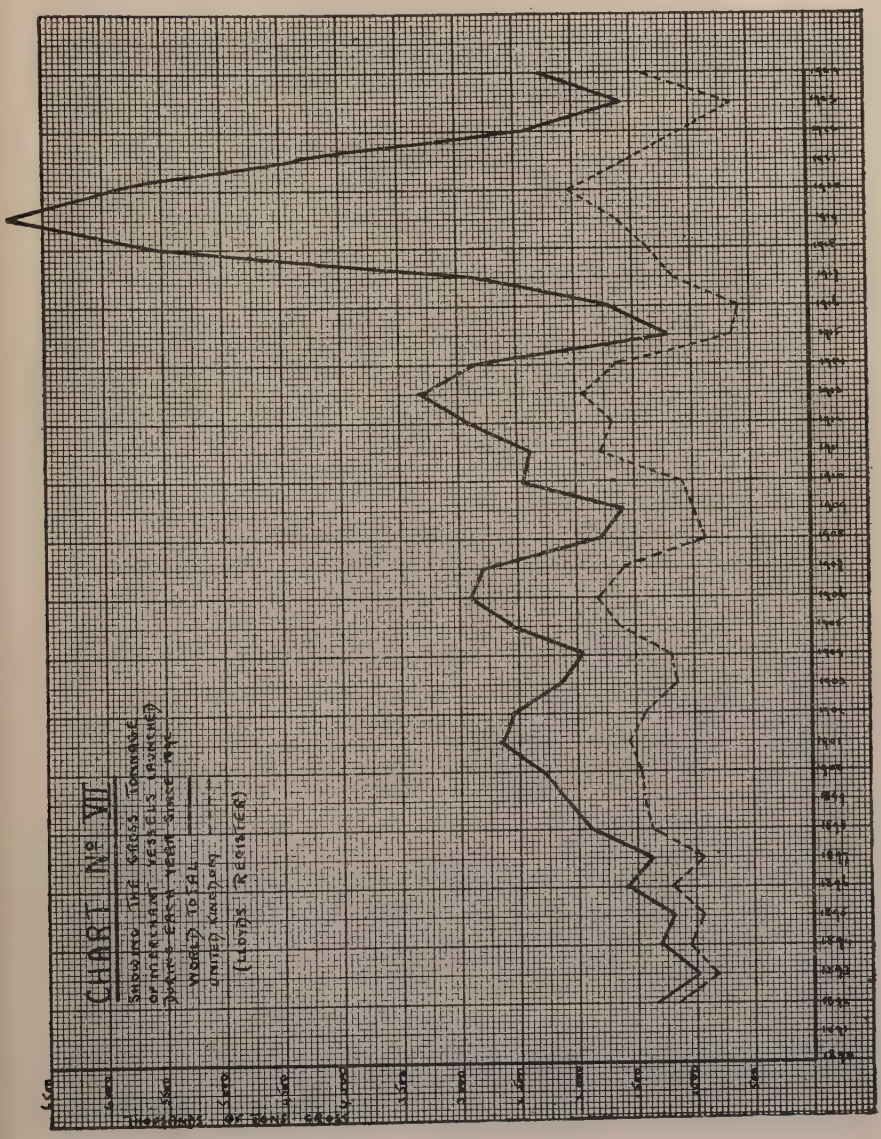


CHART No VII
Showing the gross Tonnage of merchant vessels launched during EACH YEAR since 1870
World total
United Kingdom
(Lloyds Register)

It must be realised, however, that the intermediate cycle which characterises the shipbuilding industry is customarily of very much smaller magnitude than the major cycles which correspond with the general movement of freight rates. This fact is brought out very clearly by the figures showing the tonnage launched annually in the United Kingdom (Table IX) which are plotted in the form of a derivative cycle in Chart No. VII. The outstanding peaks in this case are to be found in the years 1898, 1905, 1911, 1917, and 1924—which coincide with the peak years in the case of tonnage under construction excepting in regard to the post-war period, in which the major and minor cycle appear to have been reversed. This, however, is not actually the case, the reason being solely that the unprecedented magnitude of the figures for tonnage launched during the four years 1918–1921 has tended to dwarf the proportional significance of the increased launchings of 1921, which reached a record figure of 2,055,624 tons gross for the United Kingdom. Conversely the exceedingly low level to which the figure fell during the post-war depression has tended to magnify the increase which occurred in 1924. The time lag of a little more than a year between the peak of tonnage under construction in the last quarter of 1919 and the peak of tonnage launched in 1921, is also to be explained by the abnormality of the situation. Towards the end of the war a heavy construction programme had been embarked upon and the pressure of orders for new ships tended to increase rather than diminish in 1919, for reasons that have already been stated. Therefore the depression, when it came, found the shipyards with large unfilled orders. On many of these all work was temporarily suspended, and the completion of the others was delayed by the boilermarkers' and rivetters' strike of that year.

Figures of the aggregate gross tonnage of shipping for the whole world, published by Lloyds' Register as of June 30 each year and given in Table X, cannot be expected to demonstrate to any great extent the fluctuations in the production of ships because the annual production will constitute only a very small part of the total available supply. Thus in 1920, when the tonnage launched in the United Kingdom reached the record

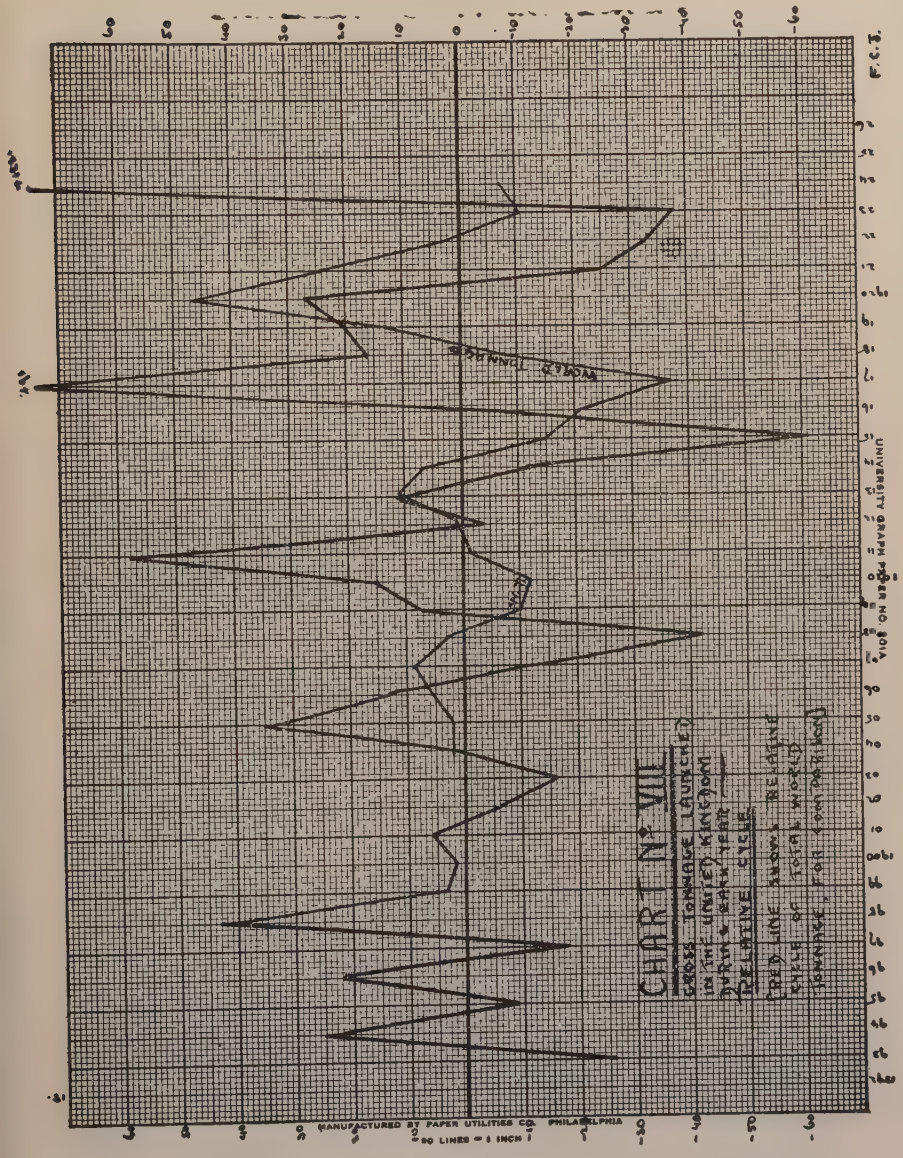


CHART N° VIII
GROSS TONNAGE LAUNCHED
IN THE UNITED KINGDOM
DURING EACH YEAR
RELATIVE CYCLE
(RED LINE SHOWS RELATIVE
CYCLE OF TOTAL WORLD
TONNAGE FOR COMPARISON)
UNIVERSITY OF PENNSYLVANIA PRESS
MANUFACTURED BY PAPER UTILITIES CO. PHILADELPHIA
100 LINES = 1 INCH

figure of 2,055,624 tons gross, the total shipping of the world despite the heavy losses suffered during the war amounted to 57,314,065 tons gross. In normal years the tonnage launched constitutes an even smaller proportion of the total available supply. The magnitude of the variations in total world tonnage will therefore be very much smaller than that of the fluctuations in ship-production, but the changes in the total supply of ships demonstrates the excess (or deficiency) of current production over the losses occasioned through obsolescence and the perils of war and the sea, and will therefore serve as an additional indicator of the fluctuations in the shipping industry. The available data for the years from 1903–1924 has been plotted in the form of a relative cycle on Chart No. VIII, and shows a series of peak years in 1907, 1913 and 1920. It will be noticed that these years coincide with the fluctuations in freight rates rather than with those in tonnage under construction or in tonnage launched, a fact which is to be accounted for by the practice of keeping obsolete ships in employment during the period of prosperity, and scrapping them when they are no longer able to find profitable employment. Evidence of this latter fact is found in the very rapid decline in the figure of total world tonnage which invariably comes in the second year of depression.

In order to complete the analysis of the shipbuilding industry and to tie it up with the business of ship operation, it will be helpful at this point to recapitulate briefly the fluctuations in the price of ships, since the price of shipping is determined by the relationship of the freight market to the available supply of shipping tonnage. The high prices of 1898 are paralleled by the peak in the figures of tonnage under construction in the last quarter of that year, and the heavy launchings which accompanied the boom may be responsible for the sharp drop in prices which followed. Similar relationships will be found to exist in 1907, 1917 and 1920. In 1903 a recovery in the price of ships seems to have led to an increase in construction, but the price relapsed rapidly as the tonnage came onto the market, and did not increase again until the short-lived spurt of 1905, which exhausted itself within the course of a year. In 1912 the

price of vessels reached its zenith when tonnage under construction was already well into the period of decline, and when launchings showed a slight increase over the previous year. The reason for this lies in the fact that the price with which we are dealing is the price of a vessel ready for immediate service. Shipowners realised that the end of the boom was not very far away and were anxious to obtain the immediate use of a vessel in order that they might reap as much profit as possible from the high level of freights prevailing at the moment. This conclusion is borne out by the fact that the contract price of vessels to be constructed ruled very much below normal throughout the whole of 1912.

The price of a new vessel, ready for immediate service, is clearly dependent upon the freight market to a very much greater extent than upon the condition of shipbuilding industry, although the dependence on shipbuilding is increased in the case of peaks of the major cycles, when shipping is fully occupied and the shipyards are working at full pressure. This condition of affairs very naturally flows from the characteristic features of the shipbuilding industry which have already been noted. At a time when the freight market is prosperous a shipowner, and especially a tramp shipowner, will pay a somewhat higher price in the open market to obtain immediate possession of a vessel rather than contract to have one built at a very much lower price, when this necessitates his waiting several months for delivery. This is not due to an ignorance or lack of foresight on the part of the shipowner, but to a hope that he may be able to make more than enough to cover the difference in price before the freight market breaks. For this reason the shipbuilding industry may be in a period of comparative depression while the market price of steamers available for immediate service is high; although this condition of affairs can only exist for very short periods of time during the latter part of the boom.

On the other hand the shipbuilding industry may show signs of increasing activity while the freight market is still depressed, for reasons that have already been presented in detail. It should, however, be remembered that in such a case the prices of new construction will never exceed the current market price

of a new vessel ready for immediate delivery, and in very many instances the increased activity of shipbuilding does not denote increased prosperity for that industry. This fact can readily be demonstrated by reference to the history of shipbuilding during 1924. If output expressed in gross tons of vessels launched and horsepower of propelling machinery completed were a true measure of the prosperity of shipbuilding, 1924 would be entitled to rank high in the records of the industry. But Sir William Mackenzie in the course of an award in a shipyard wages arbitration[8] pointed out that,

> "The state of the industry has been a matter of serious concern for the employers. In an endeavour to keep the industry going they have entered into contracts without thought of profit, and in some cases with the certainty of direct loss. On 59 contracts on new work completed by members of the executive committee of the Shipbuilding Employers' Federation since June, 1922, the sum of £233,000 has been lost, and on 83 contracts on new work not yet completed it is estimated that, on the basis of the continuance of the present wages, there will be a loss of £785,000. These figures are startling. The yards being only partially employed, the employers have incurred further liability. It is not to be understood that these contracts were a speculation which turned out badly; they were undertaken in many instances with a view to keeping the industry alive."

Before proceeding to draw together the scattered threads of the argument that has been advanced to prove the cyclical nature of shipping fluctuations it will be of advantage to analyse in detail the post-war shipping cycle, for which more data is available than in the case of any of the earlier periods.

---

[8] *Fairplay*, January 8, 1925, p. 86.

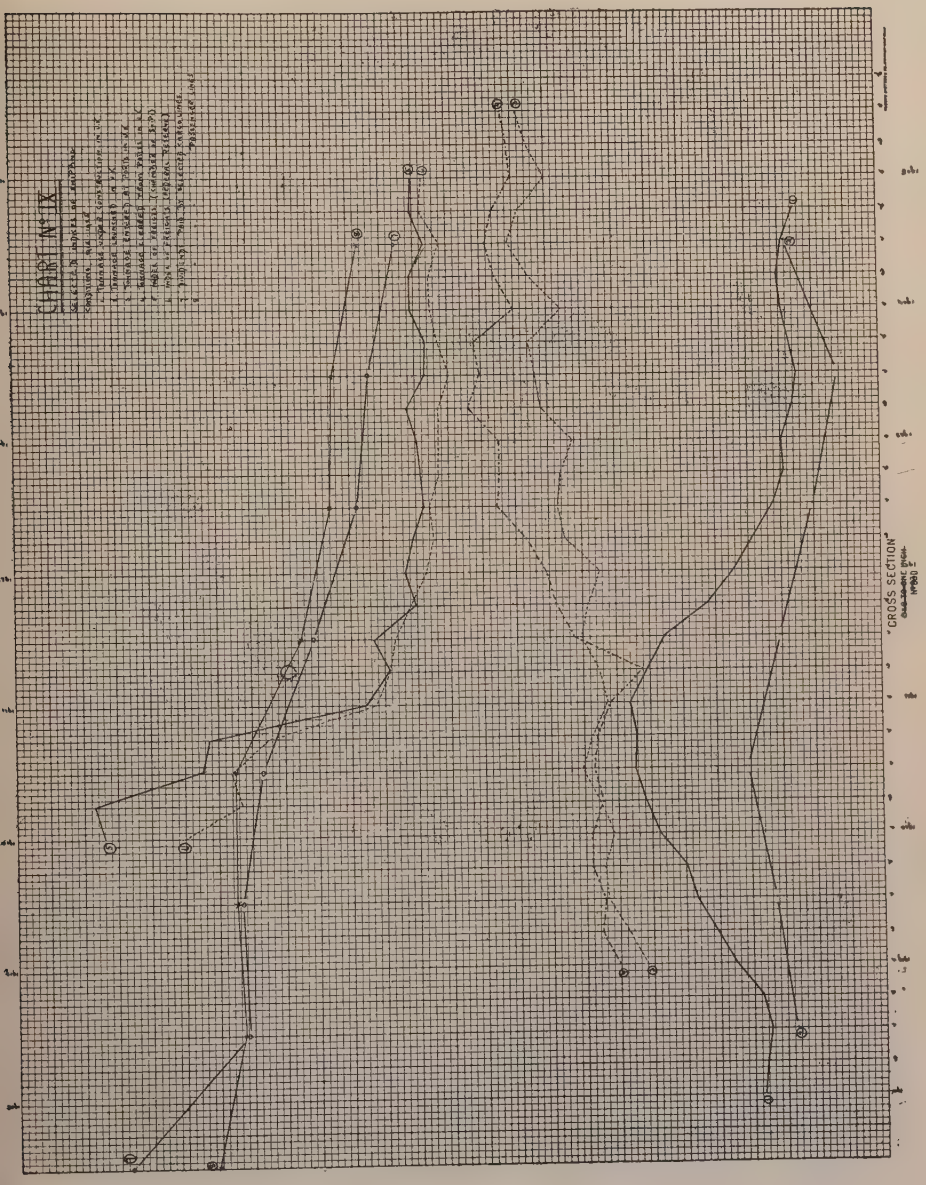


CHART N° IX
CROSS SECTION

IV

Shipping in the Post-War Period

The world that emerged in 1918 from the carnage and destruction of the War, was not the same world which so lightly took up arms in 1914. If there be anything in the old Persian idea of rebirth by fire, the world had been truly reborn and was about to enter upon a new epoch of its history, enriched by its experience and possessing a keener realisation of many of the things in life which previously had been deemed unworthy of the notice of the great nations of the earth. Scientific research in the field of economics was one of these things. The war had laid upon the shoulders of belligerent governments the burden of an autocratic administration of the economic life of the countries over whose destinies they presided, and the problem of rightly carrying that burden has brought home in many cases, especially in that of shipping, the need for adequate and accurate statistical information as to the condition of the industry at any given time. Statistical indices of freights, of idle tonnage and of volume of traffic are only a few of the many kinds of information that have come into existence since the war—so that the analysis of the post-war situation can be made with even greater certainty than was possible during the pre-war period.

But the war marked a distinct epoch in the history of the shipping industry. During the war governmental control of British shipping interfered very considerably with the operation of those economic laws which are continually in effect under the conditions of free competition which normally characterise the maritime transportation. To fully realise the present condition it will therefore be necessary to review briefly the effects of the war upon shipping.[1] In 1914 there were 3,600 British steam-

[1] Much of the information contained in this review of the effects of the War has been taken from the Annual Report of the Liverpool Steam Ship Owners' Association for 1924, to which the author desires to express his thanks.

ships registered in the United Kingdom employed in the Ocean Overseas Trades. The aggregate tonnage of these vessels was 16,500,000 tons gross, and approximately they were divided into.

	Number of Vessels	Gross Tonnage
Liners	1,200	6,900,000
Tramps	2,400	9,600,000

Of these there were lost through war perils 1,698 ships of an aggregate tonnage of 7,051,000 tons gross, the losses being divided as follows:

	Number of Vessels	Gross Tonnage
Liners	365	2,235,000
Tramps	1,333	4,816,000

The proportion of the newer and faster ships was high amongst the liner losses: they were better adapted for most war services and were therefore so employed and exposed to greater risks. These war losses have been replaced by new tonnage, mainly by vessels delivered since the conclusion of peace; but as the losses were so largely amongst the newer ships, and as the shipowners were forbidden by law from February 12, 1915, to August 31, 1924, to sell even their older ships to foreigners, the average age of the tonnage in service in 1920 was greater than it was in 1913.[2]

The original building cost of the vessels lost had averaged:

Fast Mail and Passenger Liners	£30–35 per ton gross
Passenger and Cargo Liners	£20–30 per ton gross
Cargo Liners	£12–15 per ton gross
Tramps	£10–12 per ton gross

The cost of replacement has averaged:

[2] This defect has been largely remedied during the past five years, particularly in the case of liner tonnage and of the larger modern type of tramp steamer.

Fast Mail and Passenger Liners	£70–87.5 per ton gross
Passenger and Cargo Liners	£50–70 per ton gross
Cargo Liners	£30–37.5 per ton gross
Tramps	£30–36 per ton gross

The cost of replacement has therefore been from two and a half to three times the original building cost, and the total sum paid by the British Shipping Industry to make good the war losses has been approximately £280,000,000. The increase, it must be clearly remembered, is not attributable to better building, to greater speed, or to the ships being in any respects of greater earning power: on the contrary, the work done during and immediately after the war was inferior in quality, and there was great waste of time and therefore of money in the shipyards.

The values adopted in 1914, for the purposes of the War Risks Insurance Scheme were first cost, less depreciation at the rate of 4 per cent per annum on that first cost, and although these insurable values were increased at several subsequent dates they lagged a very long way behind the increasing costs of replacement. The total amount paid in War Risks Insurance in respect of all the steamships employed in the Ocean Overseas Trade lost through war perils was £146,000,000. The whole of this insurance was paid by the shipping industry, either in the direct form of War Risk Insurance premiums, or indirectly in the lower rates of hire paid and accepted for ships for war services in consideration of the Government assuming the war perils. Even so, however, the cost of replacement exceeded by £134,000,000, or 92 per cent, the insurance money recovered. In other words, in order to replace promptly the losses occasioned by the war the British Shipping Industry had to assume for the lives of the new ships (*i.e.*, for the following twenty years) the burden of war prices grossly inflated by the minimum of labour given for the maximum rates of pay demanded.

To what extent have these capital losses been met out of the war and post-war earnings of the shipping industry? Immediately after the outbreak of war the British government, by charter and later by requisition, obtained the possession of such shipping tonnage as was needed for war service. In some cases

the Government manned and operated the vessel, in which case it naturally paid a lower rate than in those cases where it employed the services of the shipowner to manage and operate the vessel under the direction of the Government Department concerned. In both cases, however, the remuneration at Blue Book Rates was based on the pre-war earnings of shipping and was far below the market rates. With the balance of his shipping tonnage the shipowner was able to compete in the open market and thus gained some advantage from the very high level of freights prevailing. Early in 1917, however, the government, as we have already seen, requisitioned the whole of the British steamship tonnage, that is, it employed from that date the shipowners to manage and run their own ships for the Departments concerned; paid the shipowners hire at rates based upon the peace earnings of ships; and retained for the State the balance of the freights received. Under this method freights went on advancing but the British shipowner gained nothing from the higher rates. Nor did he gain very much from the short-lived boom of 1919 since he had not been able to replace his lost tonnage and was still burdened by Excess Profits Taxation.

Looked at from any angle, therefore, the British shipping industry was greatly weakened as a result of the war; a fact (it may be remarked in parenthesis) which exactly duplicates the conditions which were found to exist during the decade after the South African War. It is in the light of this fact that we must examine the post-war situation, because every cyclical tendency to prosperity will be greatly minimised in its effects by the general trend and every tendency to depression will only accentuate the general gloom which overhangs the industry.

Beginning the analysis with the figures for tonnage under construction in the United Kingdom at the end of each quarter (Table VIII), we find[3] that the cycle reaches its peak at the end of 1919, falls steadily to the lowest point reached at the end of the second quarter of 1922 and then enters upon one of the intermediate cycles which we found to exist in this industry, reaching a second peak in the third quarter of 1924. This

[3] Chart No. X.

general, and distinctly cyclical movement is supported by the annual figures for tonnage launched and the annual figures of the aggregate shipping tonnage of the world, both of which reach a peak in 1920, decline to 1923, and then rise again during 1924. The peak of the intermediate cycle has, however, been passed and shipbuilding has once more entered upon a period of decline. The Shipping Correspondent of the London *Observer*[4] makes some very interesting comments on the situation during 1924 which bear out the explanation which has already been given to account for the existence of these intermediate cycles.

"There were," he writes, "special circumstances which account for the activity of 1924. For one thing the protracted boilermakers' dispute in 1923 had the effect of holding up tonnage which normally would have been launched in that year, and there was also the fact that many owners who had ordered a suspension of work on ships under construction, came to the conclusion that in view of the probability of rising shipyard costs it would be best to take delivery as soon as possible. Some owners also took advantage of the low prices prevailing in 1922 to place orders for vessels which they anticipate will be needed with the return of trade prosperity."

Mr. Herbert Casson[5] also contributes to the elucidation of the problem when he says,

"Now that the United States has announced the plan to sell for breaking-up many of the 1335 idle ships, many of which are already obsolete in the sense that they cannot be operated economically, there is a general belief in England that there will be a healthy revival in shipping."

Although the correspondent of the *Observer* seems to place much weight on the boilermakers' dispute of 1923, the experience of past years should have led him to stress the increased construction which can largely be attributed to the psychological effect produced by the breaking-up of the older vessels in existence both in England and in other countries, especially the United States.

---

[4] January 9, 1925.
[5] *Philadelphia Public Ledger*, March 17, 1924.

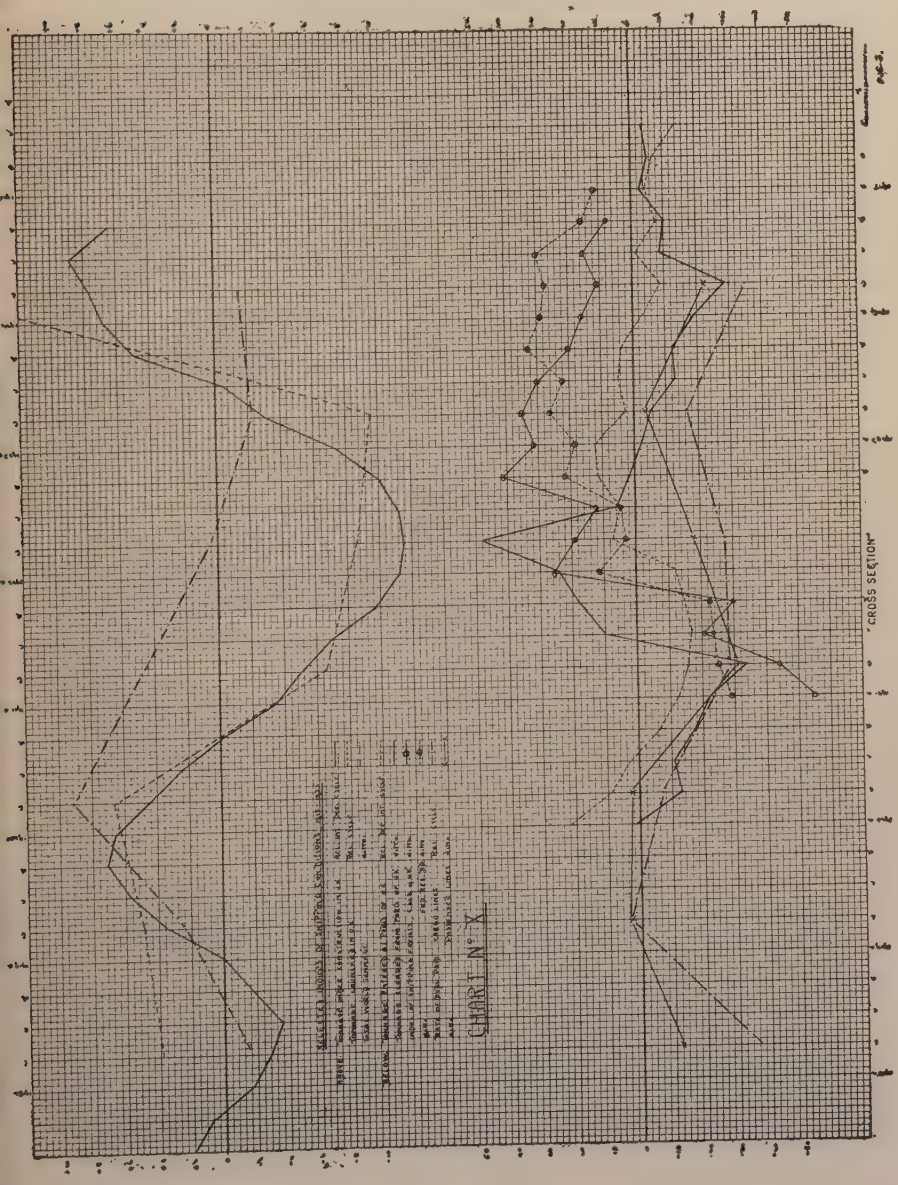


CHART N° X
"CROSS SECTION"

That shipbuilding in every country, excepting Germany, was in a deep depression throughout 1925 is very clear. The announcement on March 7, 1925, that Messrs. Furness Withy & Co., one of the largest British liner companies, had placed an order for five new motor vessels with the Deutsche Werft called forth from the same correspondent[6] a lament over "the unhappy plight into which the British shipbuilding industry has drifted."[7] Some conception of the change in the situation during the twelve months ending September 30, 1925, is contained in the Returns of Shipbuilding in the United Kingdom published by Lloyds' Register as of the latter date. A few figures of the tonnage under construction at some of the leading shipbuilding centres have been extracted from it and are presented as an indicator of the present situation.

District	September 30, 1925		September 30, 1924	
	Number	Gross Tonnage	Number	Gross Tonnage
Barrow, Maryport & Workington	3	27,430	11	82 228
Clyde: Glasgow	68	247,424	85	536,520
Greenock	37	181,020	40	220,310
Hull	25	8,936	20	21,305
Middlesborough	9	30,680	20	71,740
Sunderland	15	57,840	33	132,604

As a result of the war the world's shipbuilding plant has doubled in capacity, while the demand for ships has been greatly reduced.

[6] London *Observer*, March 8, 1925.

[7] The apparent prosperity of the German yards, which is unique in that shipbuilding all over the rest of the world is in a decline, is easily explained by the fact that Germany was deprived of her merchant marine by the Treaty of Versailles and has therefore the task of constructing an entirely new merchant marine. The economies of large scale production consequent upon such an order naturally enable her to make lower quotations than British yards could make at that time.

"It is probable, if unpalatable," writes[8] Sir Westcott Abel, Chief Ship Surveyor of Lloyds' Register, "that the United Kingdom will have to face a further reduction of 100 berths before its shipyard house is thoroughly in order."

Nevertheless, despite the heavy burden which the war has placed upon the shipbuilding industry it is very interesting to note that the cyclical nature of its fluctuations appears to have proceeded undisturbed. If we may draw upon the analysis that has been made of past cycles it would seem that we must expect this second post-war depression to continue until freights have taken a distinct upward movement and the shipping industry has again become active.

What has been the situation of the shipping industry itself during this period? We have noticed already that freights reached their peak in 1918, from which high point they declined steadily in terms of absolute figures to the third quarter of 1923. Both of the indices that have been selected agree on this movement, although it should be remarked at this point that the indices do not measure identically the same data. The index of freights prepared by the Chamber of Shipping of the United Kingdom, which is presented in Table XI, is a weighted average of freights on all the important trade routes of the world whereas the index presented in Table XII is a weighted average of rates between Europe and the United States which is compiled by the Federal Reserve Board. Because of the essentially international nature of the freight market the two figures coincide in all their more important movements, but because of their diverse nature they will differ slightly in the minor fluctuations. In Chart No. X these indices, together with several others, have been plotted in the form of relative derivative integral cycles, and from this analysis it will be seen that the pit of the depression in reality came in 1921, from which time rates expressed in terms of relatives, and after the elimination of all secular and seasonal influences, tended to rise to a high point in 1923. This general movement is in agreement with the figures for Entrances and Clearances of Shipping at British Ports, which are to be found

[8] *Brassey's Naval and Shipping Annual*, 1925.

in Table XIII. Expressed in the form of a relative integral derivative cycle these figures reach a nadir in the middle of 1921, rise to a high point in the middle of 1922 and decline somewhat thereafter. Of these two figures that of clearances is very much more important to the shipowner since the exports of the United Kingdom very much exceeded the imports in weight during the period from 1919–1924.[9] The figure for clearances advanced sharply during the second quarter of 1920 and continued to advance during the whole of the following twelve months. Freights followed this movement very closely with a time lag of about six months and when the figure for clearances declined relatively the increase in the figure for entrances (which accompanied the increase in the physical volume of imports) supported the freight market until well on into 1923. Coal, which constitutes the largest portion of the volume of the exports from the United Kingdom also contributed materially to the period of comparative prosperity in 1923, since the coal exports of that year amounted to 84,487,000, a figure larger than the corresponding one for any single year since 1913, and larger by nearly 20,000,000 tons than the figure for 1924. Indeed freights at the end of 1924 were still in the positive phase of the cycle, although they evidenced a tendency to decline which was continued throughout 1925.

The tonnage of shipping laid-up in British ports, figures of which are presented in Table XV, show successive decreases throughout 1923 and 1924 after the heavy seasonal element has been eliminated, which supports the conclusions reached above and demonstrates that the upward movement of freights during 1922–23 led many shipowners to recondition their vessels for service—a fact which aided in the decline which is evident in the freight markets during 1924 and 1925.

The rate of dividends paid by steamship companies, which is also plotted on Chart No. X in the form of a relative cycle, also shows a distinct peak in 1923, although it is a minor one and occurs during the negative phase of the major cycle; and the price of a new ready 7500-ton cargo steamer shows an advance

[9] See the figures of the volume of Trade contained in Table XIV.

from £62,000 in the second quarter of 1922 to £63,500 in the third quarter and to £65,750 at the end of the year and during the early part of 1923.

It seems therefore that no matter which one of the several available indices is analysed, the period from 1918 to 1925 contains a complete cycle; and, although the severe conditions of the post-war period (which may well create a depressing trend for some years to come) occasionally obscure this fact in the writings of contemporary observers, there are to be found many evidences of its existence in current comments upon the shipping industry. Thus on February 22, 1924, in his Presidential address before the Chamber of Shipping of the United Kingdom, Sir Alan Anderson said,

"Your President addressed you in 1921 'in the throes of a very severe slump.' His successor took up the parable a year later, 'in the midst of the deepest depression shipowning has ever experienced.' He was followed last year by Sir Ernest Glover, who remarked about the year 1922: 'The past year has proved that however deep the abyss may be into which shipping has fallen, there is always the possibility of the bottom of the abyss dropping out. In several of the main trade routes of the world we have seen rates of freight in 1922 less than half the average rate in 1921, which was a bad year.'" "My three illustrious predecessors," he continued, "seem to have left me no unused superlative of disgust to describe the Shipping Trade in 1923; but with all respect to Sir Ernest Glover there is a definite bottom to the abyss of bad freights and we have touched bottom. . . . Freights in 1923 only fell 4 per cent below those of 1922 because on the average there was an approximately equal drop in the expenses of ship operation."

Continuing the series of very enlightening Presidential comments, Mr. John Denholm in February, 1925, pointed out that,

"A survey of the whole industry reveals the fact that the working expenses of ships (during 1924) were a little less, largely owing to the decreased cost of coal and insurance, while the open market for freights was throughout the greater part of the year slightly higher than during the corresponding months of 1923."

In the field of shipping as well as in the shipbuilding industry, 1925 saw a depression even greater than that which had pre-

ceded the short-lived boom of 1923. But there arises out of this analysis of the post-war period a very interesting problem. Does there exist an intermediate cycle in the shipping industry similar to that which was found to exist in the case of shipbuilding? The revival of freight rates which gave rise to the minor peaks in 1903 and 1910, together with the rise in the price of vessels during those years, lead to the assumption that such intermediate cycles as the one which is so clearly evident in 1920–1924 may occur regularly between the peaks of the major cycles, in which case there would be an even closer relationship between the cyclical fluctuation in the shipping industry and those in the shipbuilding industry. The suggestion gives much food for thought but the definite mathematical proof of its existence must await the passing of another decade during which a sufficient amount of accurate information will have been compiled to demonstrate the truth or falsity of the assumption.

V

The Shipping Cycle

Sometimes the experiments of the chemist will reveal to him even more than was disclosed by the theoretical deductions from formulae upon which he based his experiment. The present study has had a somewhat similar result; for not only has it demonstrated very clearly the existence of a major shipping cycle but it has also shown that cycle to be very distinct and very regular. Moreover when we have been enabled to make a very minute examination of adequate data—as in the case of the shipbuilding industry or of the shipping industry itself during the period after the war—it has revealed the existence of an unexpected intermediate cycle between the peaks of the major cycle.

Reviewing briefly the period under review, there has been shown to have existed four distinct cycles which reached their peaks in 1887–9, 1889–1900, 1905–7, 1912–13, and 1918–20.[1] The first of these cycles occupies a complete decade, but each of the remaining three completes itself within six years and it is probable that this may be taken to be the approximate duration of the shipping cycle. Following regularly at an interval of about four years we have the peaks of the intermediate cycles in 1894–6, 1902–3, 1909–10, 1916–17 and 1922–24. Restating the sequential movement of a typical cycle, we shall obtain a picture along the following lines.

Starting with a period of depression such as that existing at the present time the first indications of a revival come with an increase in ocean traffic as demonstrated by an increase in the tonnage entered at or cleared from the important shipping ports. Freights increase rapidly after a lag of from three to six months, and with them the price of vessels ready for immediate service also tends to increase. For a while the shipbuilding industry is

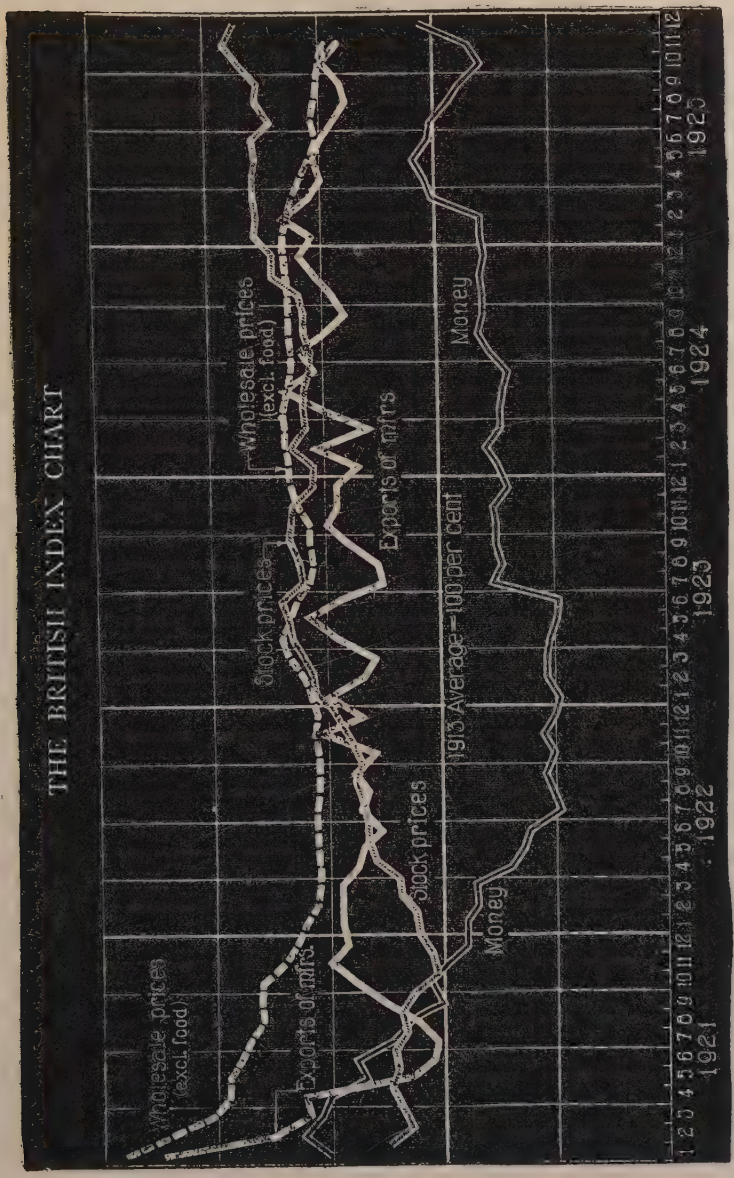
[1] The spread of years at each peak is due to the time lags found to exist regularly between the various indices used.

not affected, but as the available tonnage comes fully employed the shipyards receive orders for new vessels and very rapidly enter upon a period of prosperity. The net profits of shipping companies tend to increase about a year before the rise in freights, and during the whole of this period of revival they are rising rapidly.

The first indication of the end of the period of prosperity is found in the shipbuilding industry, where no new orders are received when the immediate demand has been met. Tonnage under construction and tonnage launched both decline rapidly although the figure of total tonnage in operation tends to increase owing to the fact that shipowners are keeping their older vessels in service during the boom in order to reap as much advantage as possible from the high freights. Freights continue to advance for another 12 or 18 months and the price of new vessels ready for immediate service may still rule high, but the net profits of shipping companies show a tendency to decline (or at best are increasing at a rapidly diminishing rate) on account of the increased cost of operation.

Meanwhile there has come upon the market a good deal of new tonnage to swell the supply and when after a while the physical volume of traffic ceases to increase, or begins to decrease on account of a commercial crisis, the supply of shipping tonnage exceeds the demand at the existing level of freights. Freights drop rapidly on account of the fierce competition among tramp vessels and profits fall correspondingly. Vessels begin to be laid-up, or if they are already obsolete, to be scrapped—and shipowners that have vessels under construction will in all probability order work to be suspended for the time being. The whole industry falls very rapidly into a depression.

After a while, however, the shipyards will enter upon a period of increasing activity (although this may not mean increasing prosperity). Work will be resumed on the tonnage already under construction, and liner companies planning for future development may also place new orders. At the same time the physical volume of traffic will tend to increase on account of the increase in the physical volume of business which invariably comes very soon after the crisis. Freights may rise somewhat,


THE BRITISH INDEX CHART
Wholesale prices (excl. food)
Exports of mfrs.
Stock prices
Money
1913 Average = 100 per cent
1921
1922
1923
1924
1925

as will the price of new vessels ready for immediate service. But the peak of the intermediate cycle is very soon reached. The slight increase in freights has led to the reconditioning of some of the laid-up tonnage, and the increased activity of shipyards has further increased the available supply of tonnage. Freights fall rapidly to an even lower level than before and both shipbuilding and shipping enter upon a period of deep depression from which they will only be aroused by a general revival in trade.

While the present study is intended solely as an analysis of the cyclical fluctuations in the shipping and shipbuilding industries, and has been devoted exclusively to the problems of these industries, it would evidently be of greater value to the general reader if it were possible to correlate the results obtained with some measure of the general business cycle. The task is not an easy one: as was pointed out in an earlier chapter, shipping is essentially international and it therefore feels the booms and depressions of business in any part of the world. To compare shipping satisfactorily with any measure of the general business cycle, that measure would need to be international—but no such index of the cyclical fluctuations in business is available. Indeed, it is the hope of the author that by a continuation and perfection of the analysis of the cyclical fluctuations in the shipping industry, that industry may serve the purpose of an international barometer of business!

The analysis has been entirely confined to British shipping, however, and it might seem that a comparison might well be made with some index of general business conditions in the United Kingdom. The validity of such a correlation is somewhat doubtful—but even if it were very great we should be no nearer the solution of the problem because there does not exist any index of general business conditions in the United Kingdom! Although the realisation of the need for such an index has grown rapidly during the last few years, the demands of the business world have not yet been emphatic enough to lead to the creation of the desired business barometer. The best indicator available is found in the four series of figures issued by

the London-Cambridge Economic Service,[2] and these are presented for comparison in Chart XIII, subject to the several qualifications already given.

Taking first of all the figures for shipbuilding,[3] it will be remembered that tonnage under construction declined from a peak in the fourth quarter of 1919 to a nadir in the second quarter of 1922, and then rose again to a minor peak in the third quarter of 1924—all of which movements coincide with those of the figures for tonnage launched and total world tonnage. If we compare this with the money curve of the London-Cambridge Economic service, we find that the shipbuilding peak occurred five quarters earlier in the first case and three quarters earlier in the second, while the nadirs coincided approximately. None of the other figures in the chart show sufficient cyclical movement to make any correlation possible. Nor do the figures of ship operation give any better results. Freight rates reached a peak three years before money rates, declined to a nadir one year earlier and reached their minor peak two years before the peak of money rates in the second quarter of 1925. Entrances and clearances show a fairly close relationship, but dividends show no correlation at all.

To draw conclusions from such unlike comparisons over so short a period would be worse than useless. It may be that when some reliable index of business conditions has been created, the fluctuations of shipping will show a definite correlation with it, but for the present we must rest content with the demonstration of a cycle within the shipping and shipbuilding industries themselves.

---

[2] Which came into existence as late as 1921.
[3] Chart No. X.

BIBLIOGRAPHY

NOTE: Published books have been of comparatively little use in the making of this study, and those listed have served to give a general background rather than as direct sources of information. Most of the information upon which the study has been based has been obtained from personal correspondence with persons in the shipping business, or from current periodicals of which the chief are listed below.

Annual Reports of the Chamber of Shipping of the United Kingdom.

Annual Reports of the Liverpool Steam Ship Owners' Association.

Brassey's Naval and Shipping Annual.

Fairplay, (weekly).

Economist, London (weekly).

Lloyds' Register of Shipping (annual).

Lloyds' List (daily).

London *Daily Telegraph* and *Times.*

Manchester Guardian Commercial.

Federal Reserve Bulletin.

Philadelphia *Public Ledger.*

Abell, Sir Westcott, *The World's Mercantile Marine.*

Bates, W. W., *American Marine.*

Johnson, E. R. and Huebner, G. G., *Principles of Ocean Transportation.*

Jones, Clement, *British Merchant Shipping.*

Jones, J. H., *The Shipbuilding Industry in "Is Unemployment Inevitable?"*

Kirkaldy, A. W., *History of British Shipping.*

Knowles, L., *Industrial and Commercial Revolutions.*

Marshall, A., *Industry and Trade.*

Marshall, A., *Money, Credit and Commerce.*

Mitchell, W. C., *Business Cycles.*

Salter, J. A., *Allied Shipping Control.*

Sargent, A. J., *Seaways of the Empire.*

Smith, J. R., *The Influence of the Great War on Shipping.*

Smith, J. R., *The Ocean Carrier.*

Van Pelt, H., *America's Shipping Earnings and the Balance of Trade.—Federal Reserve Bulletin, April, 1921.*

Zimmerman, O., *Ocean Shipping.*

Government Publications

United Kingdom: *Annual Returns of Trade and Navigation.*
Monthly Returns of Trade and Navigation.
Report on Shipping and Shipping Rings, 1909.
Report on Shipping and Shipbuilding After the War, 1918.

United States: *Hearings on the Subsidy Bill, 1922.*
Statistical Publications of the U. S. Shipping Board.

APPENDIX

A Note on Statistical Method

When economic data is recorded in a manner which renders it suitable for mathematical analysis, and when, moreover, there is reason to suspect the existence of cyclical fluctuations, we may postulate three distinct movements within the mathematical series, namely:

1. *A secular trend*, which may be defined as "any movement in the data which does not repeat itself within the period of two cycles." This is the mathematical statement of the general direction in which the data is tending to move, and while it is not necessary to assume that the direction of trend should remain indefinitely the same, the trend does by its nature frequently continue in the same direction for considerable periods of time. To take but one example as illustrative of this conception, it is clear from the table showing the aggregate gross tonnage of vessels afloat at the end of each year during the past quarter of a century that there is an upward secular trend during the whole period.

2. *A seasonal variation*, or one which repeats itself within the period of two years, but does not repeat itself within a single year. Elaboration of this point is unnecessary, since the seasonal movement in many branches of economic activity (such as the money market) has long been clearly understood by students.

3. *A cyclical movement*, which constitutes the residual after the first two have been eliminated and which may be defined as a movement in the data which repeats itself within the period of two cycles, but not within a period of two years.

These three factors are all present in the original data, and the student is therefore compelled to attempt the elimination of the secular trend and seasonal variation by some mathematical process in order that he may measure the cycle. This may be done in any one of several ways, but only those which have been used in this study will be mentioned here: they are the Simple Chain Index Method, the Relative Derivative Method, the Relative Derivative Integral Method, and the Relative Integral Derivative Method.* All three of these are based upon a comparatively simple mathematical

---

*Note: The thanks of the writer are due to Dr. Lincoln W. Hall, of the University of Pennsylvania, for his assistance in the selection of appropriate methods and also for permission to make use of the Relative Derivative Methods, which have not yet been published.

analysis and the choice of method in each case has been determined very largely by the data available. Where quarterly data of an authentic nature could be obtained either the Relative Derivative or the Relative Integral Derivative Methods were used, but where only annual figures existed resort was had to the Simple Chain Index Method, which is admittedly less accurate but is sufficiently reliable to give satisfactory results in the majority of cases.

Let us assume that X represents any given ordinate taken from the original data, and that U, V and W respectively represent the secular trend, seasonal variation and cyclical fluctuation; we then get the equation:

$$X_k = U_k + V_k + W_k$$

Therefore

$$\frac{X_k}{X_{k-1}} = \frac{X_k + X_{k-1} - X_{k-1}}{X_{k-1}}$$

$$= \frac{X_{k-1}}{X_{k-1}} + \frac{X_k - X_{k-1}}{X_{k-1}}$$

$$= 1 + \frac{X_k - X_{k-1}}{X_{k-1}}$$

Similarly

$$X_{k-1} = U_{k-1} + V_{k-1} + W_{k-1}$$

$$\therefore X_k - X_{k-1} = (U_k + V_k + W_k) - (U_{k-1} + V_{k-1} + W_{k-1})$$

$$= (U_k - U_{k-1}) + (V_k - V_{k1-}) + (W_k - W_{k-1})$$

$$\therefore \frac{X_k}{X_{k-1}} = 1 + \frac{(U_k - U_{k-1}) + (V_k - V_{k-1}) + (W_k - W_{k-1})}{X_{k-1}}$$

Being concerned primarily not with the magnitude of the data but with the fluctuations that occur in it, we may ignore the unity and concentrate our attention on the finite derivative. Let us suppose that neither seasonal nor cyclical variations existed in a given series (*i.e.*, that both V and W were equal to zero), then if the series is positive and corresponds to a straight line there will be a constant difference between U_k and U_{k-1}, but this will be divided by a constantly increasing number and so the result will tend to grow gradually smaller. (Conversely if the series is diminishing there will be a constantly increasing negative result.) If the rate of increase in the trend (whether positive or negative) is not constant, but of a parabolic nature, then the chain indices will actually give a horizontal straight line, and in any event the

trend in this case will approximate very closely to a horizontal straight line. Finally if there is no trend in the original data, the same will hold true of the chain indices. We have therefore in any case greatly minimised the influence of secular trend, and if the original data consist of large numbers and the trend is not proportionately great (conditions typical of shipping data), we have secured a derivative which will serve as a measure of the joint cyclical and seasonal movement, since the process of calculating chain indices does not in any way disturb the seasonal or cyclical element in the orlginal data. Moreover if annual figures are used they will by the nature of the case include no seasonal element, so that this method has been made use of to determine the cyclical fluctuation, as previously stated, in those instances where only annual data was available.

Where quarterly data has been found the method can be made even more accurate by a process of averaging. This is based upon the fact that the cyclical movement will cancel itself out if the derivatives for the complete period of the cycle are averaged with due regard to sign, and the same will hold true of the seasonal derivatives averaged through any given year. But we are anxious to retain the cyclical element, since it is that with which we are primarily concerned. An average is therefore taken of the comparable quarters of three years, *i.e.*, three first quarters are averaged, three second quarters and so on. This process is carried through the whole data on a moving average basis, *i.e.*, the first year is dropped and fourth is added; the second is dropped and the fifth added, and so on until the data for the whole period has been dealt with. Since these figures are calculated out of the original derivatives the result will include both the seasonal and the secular elements, so that by subtracting this figure from the original relative for each period we can obtain the cyclical element.

In the case of the Relative Integral Derivative Method, the same process is followed excepting that the items of original data are first of all integrated over four or five quarters (according as to whether it is desired to eliminate or retain the seasonal element) before the derivative is obtained. The advantage of this additional step is to be found in the greater smoothness of the resultant cycle, which is not, however, modified in any way as to its period by the process of integration. In this, as n the previous method, Dr. Hall's method of moving averages is used in order to provide immediately for any possible change in the nature or intensity of either the secular or the seasonal element. Another variant of this process giving similar results is the Relative Derivative Integral Method, in which the integration takes place after, instead of before, the derivation, *i.e.*, the relative derivatives are first ca'culated and are then integrated over four or five quarters. Of these two methods the first gives a smoother cycle, and the second has only been used where it was desired to

EXAMPLE OF MATHEMATICAL METHOD

	ORIGINAL DATA	CHAIN INDEX	DEVIATION FROM 100	SECULAR-SEASONAL ELEMENT	RELATIVE DERIVATIVE CYCLE	RELATIVE DERIVATIVE CYCLE 4 QUARTER INTEGRALS	ORIGINAL DATA 5 QUARTER INTEGRALS	CHAIN INDEX RESIDUALS	SECULAR-SEASONAL ELEMENT	RELATIVE INTEGRAL DERIVATIVE CYCLE
	5,588									
	6,977	124.9	+24.9	+14.9	+10.0					
	8,443	121.0	+21.0	+16.9	+ 4.1					
1919	8,558	101.4	+ 1.4	− 3.7	+ 5.1					
	7,957	93.0	− 7.0	− 9.5	+ 2.5	+21.6	37522			
	8,904	111.9	+11.9	+14.9	− 3.0	+ 8.7	40839	+8.8	+5.8	+3.0
	10,196	114.5	+14.5	+16.9	− 2.4	+ 2.2	44058	+7.9	+5.5	+2.4
1920	9,470	92.9	− 7.1	− 3.7	− 3.4	− 6.3	45085	+2.3	+1.3	+1.0
	8,327	87.9	−12.1	− 9.5	− 2.6	−11.4	44854	− .5	0	− .5
	8,983	107.9	+ 7.9	+14.9	− 7.0	−15.4	45880	+2.3	+5.8	−3.5
	10,187	113.4	+13.4	+16.9	− 3.5	−16.5	47163	+2.8	+5.5	−2.7
1921	9,623	94.5	− 5.5	− 3.7	− 1.8	−14.9	46590	−1.2	+1.3	−2.5
	8,718	90.6	− 9.4	− 9.5	+ .1	−12.2	45838	−1.6	0	−1.6
	11,236	128.9	+28.9	+16.2	+12.7	+ 7.3	48747	+6.3	+5.8	+ .5
	11,755	104.6	+ 4.6	+10.8	− 6.2	+ 4.7	51519	+5.7	+5.5	+ .2
1922	11,683	99.4	− .6	− 4.4	+ 3.8	+10.4	53015	+2.9	+1.3	+1.6
	10,680	91.4	− 8.6	−10.0	+ 1.4	+11.7	54072	+2.0	0	+2.0
	13,081	122.5	+22.5	+19.8	+ 2.7	+ 1.7	58435	+8.0	+5.5	+2.5
	13,523	103.4	+ 3.4	+ 7.1	− 3.7	+ 4.2	60722	+3.9	+4.1	− .2
1923	13,799	102.0	+ 2.0	− 1.4	+ 3.4	+ 3.8	62766	+3.4	+1.7	+1.7
	11,467	83.1	−16.9	−11.6	− 5.3	− 2.9	62550	− .4	0	− .4
	13,814	120.5	+20.5	+24.0	− 3.5	− 9.1	65684	+5.0	+6.4	−1.4
	15,427	111.7	+11.7	+ 6.6	+ 5.1	− .2	68030	+3.6	+4.4	− .8
1924	14,643	94.9	− 5.1	− 1.2	− 3.9	− 7.6	69150	+1.6	+2.6	−1.0
	12,511	85.4	−14.6	−13.4	− 1.2	− 3.5	67862	−1.9	− .1	−1.8
	13,940	111.4	+11.4	+18.1	− 6.7	− 6.7	70335	+3.6	+5.5	−1.9
	14,660	105.2	+ 5.2	+ 7.0	− 1.8	−13.6	71181	+1.2	+2.9	−1.7
1925										

magnify the fluctuations for purposes of correlation as in the case of the analysis of the intermediate cycle of the post-war period.

To have reproduced in toto all of the mathematical calculations connected with this study would have enlarged its bulk many times but would have served no useful purpose. It has therefore seemed best to the writer to omit all of these calculations, and to give only the principal figures of original data out of which they were calculated. Nevertheless the statistical treatment of a single series of data by each of the above methods is given to illustrate what has already been explained in this appendix, and to demonstrate to the reader in graphic form the application of these methods.

A question may have arisen in the reader's mind as to whether or not the choice of a three-year moving average might in some way have influenced the periodicity of the cyclical movement. Would the results have been different if a five- or seven-year basis had been employed? By a series of experiments the writer has found that the results that would be obtained from the use of larger periods in the process of averaging are in all respects similar to those obtained from the use of a three-year period; and so this period has been adopted to simplify the mathematical calculation. The results obtained are moreover corroborated by the use of the method of Derivatives of Chain Indices in which no arbitrary choice of a time-period is necessary. In this method a chain index is first calculated out of the successive items of original data, and the derivatives obtained are integrated over four quarters on a moving basis (thus eliminating the seasonal element). The integral for the fourth quarter of the first year is then subtracted from the integral for the fourth quarter of the second year, and since each of these integrals contain four units of secular trend the differentiation will tend to eliminate the secular trend. What remains then is an integral of four units of the cyclical element, so that dividing this integral by four, we are enabled to obtain the cyclical ordinate for the fourth quarter of the second year. This process of calculation is carried right through the data on a moving basis and gives results identical in their major features with those obtained from the use of the other methods.

None of the cycles given are calculated on the basis of the Derivatives of Chain Indices, because the method was not known to the writer until the study was almost complete. At that stage it was thought best to continue to use the previous methods in order that all the results obtained might not be open to ob ections on the basis of a change in methods. Nevertheless the method has been used to verify the results obtained by the Relative Derivative Methods, and the result has proved the accuracy of the methods previously used.

TABLE I

Angiers Index of Shipping Freights 1884–1924

(1900 = base year)

YEAR	INDEX	YEAR	INDEX
1884	116.0	1904	59.5
1885	104.0	1905	62.3
1886	101.5	1906	68.
1887	100.3	1907	69.
1888	110.5	1908	60.8
1889	122.0	1909	65.8
1890	106.0	1910	66.5
1891	100.3	1911	78.5
1892	87.0	1912	106.5
1893	83.5	1913	90.0
1894	79.8	1914	69.6
1895	71.0	1915	257.9
1896	80.0	1916	563.3
1897	81.5	1917	785.3
1898	90.3	1918	788.0
1899	81.5	1919	570.3
1900	100.0	1920	394.7
1901	73.0	1921	142.6
1902	62.5	1922	109.8
1903	62.0	1923	98.7
		1924	102.1

Reproduced from data obtained from *Fairplay*.

TABLE II

Table Showing Cargo-Boat Earnings From 1904 to 1924

YEAR	PAID-UP CAPITAL	DEBENTURES, LOANS, ETC.	BOOK VALUE OF STEAMERS	NO. OF VESSELS	TONS GROSS	PROFIT ON VOYAGES, ETC.	DIVIDEND ON CAPITAL	PER CENT	DEPRECIATION WRITTEN OFF	DEPRECIATION AT 5%
	£	£	£			£	£		£	£
1904	7,594,278	3,157,128	10,753,752	393	1,184,353	640,541	277,129	3.64	216,154	622,725
1905	8,577,424	3,775,681	12,353,849	464	1,362,049	762,698	286,005	3.33	238,505	740,901
1906	8,081,800	3,699,142	12,130,285	433	1,336,823	979,545	327,445	4.05	348,651	731,971
1907	9,167,259	4,448,905	13,732,764	490	1,536,401	1,079,257	383,077	4.17	413,390	832,716
1908	9,622,401	4,409,343	14,338,652	533	1,695,837	1,145,387	335,165	3.48	393,696	876,170
1909	9,517,011	4,985,051	13,915,494	508	1,603,341	647,997	179,886	1.89	189,043	837,890
1910	9,457,650	5,548,999	14,610,877	522	1,725,335	842,511	217,681	2.30	290,115	864,187
1911	9,883,584	6,261,588	15,717,739	535	1,833,360	1,471,541	370,061	3.73	506,040	943,088
1912	10,559,843	6,058,067	16,477,354	561	1,981,209	2,869,516	720,558	6.82	1,463,919	1,011,028
1913	10,964,108	5,490,388	16,682,965	598	2,121,427	5,505,850	1,377,615	12.56	3,344,643	1,073,665
1914	10,842,026	4,677,571	15,587,708	569	2,067,403	3,828,093	1,126,069	10.38	1,944,463	1,003,349
1915	14,107,510	6,356,310	17,619,870	585	2,338,868	3,742,103	1,613,673	11.48	2,221,089	1,085,437
1916	14,822,359	8,351,803	16,012,855	499	1,952,503	10,966,863	2,743,102	18.50	3,345,577	967,623
1917	13,566,695	14,505,003	25,773,962	427	1,740,431	5,793,772	2,610,662	19.24	2,493,662	957,015
1918	12,798,871	9,984,371	23,048,026	431	1,161,473	2,574,478	1,554,832	12.15	711,201	823,461
1919	14,215,650	9,315,519	24,681,243	324	1,077,736	3,338,675	1,772,808	12.47	853,128	731,634
1920	20,737,584	12,620,615	35,264,416	362	1,176,292	6,337,198	2,380,660	11.48	1,968,725	1,623,465
1921	21,788,179	12,355,469	35,925,440	337	1,169,383	4,236,492	1,771,326	8.13	1,800,560	1,608,819
1922	28,211,560	14,176,383	43,766,281	367	1,413,838	2,679,456	1,633,353	5.79	1,005,790	1,909,611
1923	27,857,908	13,891,884	44,682,875	416	1,667,168	2,483,418	1,341,715	4.81	866,770	2,095,764
1924	30,771,268	12,416,554	46,075,805	440	1,886,387	2,100,579	947,720	3.08	1,060,002	2,060,844
Average	14,435,474	7,925,513	22,340,438	466	1,633,886	3,096,475	1,141,454	7.90	1,222,625	1,114,350

Figures reproduced from *Fairplay*.

TABLE III

Table Showing Earnings of Passenger Lines 1906–1924

YEAR	PAID-UP CAPITAL	DEBENTURES	SUNDRY CRS. AND LOANS	BOOK VALUE OF FLEET	SUNDRY DRS. INVESTMENTS ETC. £	NO. OF VESSELS	TONS GROSS	DIVIDEND PAID £	PER CENT
1906	20,340,129	10,891,838	——	33,040,293	——				
1907	18,816,338	12,819,883	——	31,848,723	——	805	3,174,507	909,015	4.46
1908	20,475,208	15,980,466	——	37,640,603	——	672	2,917,709	856,392	4.55
1909	21,088,366	12,430,700	12,622,243	43,306,771	——	800	3,546,987	934,297	4.56
1910	21,211,360	14,462,764	10,823,824	43,220,365	11,856,852	845	3,885,415	865,264	4.10
1911	22,611,740	16,310,809	11,780,307	46,146,335	12,370,064	874	4,117,147	1,030,104	4.85
1912	22,165,124	14,406,272	13,391,364	46,739,492	15,401,555	921	4,399,806	1,372,124	6.06
1913	27,067,236	18,369,916	14,438,145	56,780,878	13,987,154	884	4,182,828	1,726,861	7.79
1914	30,222,875	17,884,007	15,597,376	60,047,934	19,111,746	920	4,794,398	2,808,030	10.37
1915	31,459,709	19,135,265	20,270,898	57,287,224	18,127,448	966	5,106,495	2,605,182	8.26
1916	32,519,904	19,069,636	29,654,008	62,872,792	29,459,766	895	5,046,845	2,560,845	8.14
1917	37,789,577	17,649,355	43,812,032	81,445,855	42,170,479	869	4,908,021	3,858,846	11.87
1918	40,447,437	17,178,608	56,560,074	97,923,044	43,582,948	925	4,884,243	5,327,349	14.09
1919	33,791,883	15,913,724	64,346,186	88,494,822	54,579,141	1021	5,266,386	5,071,809	12.54
1920	37,206,376	14,836,380	66,675,951	109,919,845	57,703,378	646	3,602,910	4,383,983	12.97
1921	48,281,957	13,808,107	93,325,154	132,149,680	42,691,277	714	4,204,168	4,906,431	13.18
1922	52,461,377	19,908,649	73,316,716	128,882,786	53,497,538	866	5,187,280	4,335,842	8.98
1923	55,928,856	26,639,670	62,531,957	132,057,389	43,766,845	887	5,005,593	3,875,931	7.39
1924	60,842,494	28,810,682	58,711,316	131,411,535	42,316,983	833	5,197,884	3,954,938	7.07
					44,490,271	1167	5,184,786	3,400,463	5.50
Average.	33,406,734	17,184,565	——	74,800,861	——	869	4,453,337	2,883,323	8.63

(Figures reproduced from *Fairplay*.)

TABLE IV

NET PROFIT PER GROSS TON OF THE OCEANIC STEAM NAVIGATION CO. (White Star Line) for each year 1885–1923

DATE	GROSS PROFIT PER NET TON	INDEX ON 1900 AS BASE	DATE	GROSS PROFIT PER NET TON	INDEX ON 1900 AS BASE
	£ s. d.			£ s. d.	
1885	2 . 9 . 5	56.69	1904	1 . 10 . 2	34.60
1886	2 . 18 . 7	67.20	1905	2 . 3 . 4	49.71
1887	3 . 7 . 10	77.82	1906	2 . 10 . 4	57.74
1888	4 . 4 . 6	96.94	1907	2 . 10 . 5	57.83
1889	4 . 8 . 10	101.91	1908	0 . 16 . 0	18.35
1890	4 . 17 . 0	109.36	1909	1 . 12 . 9	37.57
1891	3 . 11 . 10	81.45	1910	2 . 16 . 6	64.81
1892	3 . 6 . 11	76.76	1911	2 . 11 . 0	58.60
1893	3 . 2 . 7	71.79	1912	2 . 1 . 11	48.08
1894	2 . 16 . 5	64.72	1913	2 . 10 . 3	57.64
1895	2 . 18 . 6	67.11	1914	1 . 19 . 6	45.31
1896	4 . 2 . 0	94.11	1915	4 . 3 . 5	95.69
1897	4 . 4 . 8	97.13	1916	5 . 6 . 1	121.70
1898	4 . 4 . 3	96.65	1917	3 . 11 . 0	81.45
1899	2 . 4 . 8	51.12	1918	3 . 2 . 5	71.60
1900	4 . 7 . 2	100.00	1919	3 . 19 . 0	90.45
1901	2 . 0 . 2	46.08	1920	2 . 13 . 11	61.84
1902	2 . 6 . 6	53.34	1921	3 . 9 . 6	80.00
1903	2 . 1 . 9	47.89	1922	2 . 13 . 8	61.56
			1923	1 . 17 . 6	43.01

TABLE V

Quantity and Value of Overseas Trade

Year	Imports		Exports	
	Value Recorded	Volume of Trade	Value Recorded	Volume of Trade
1890	103	129	118	137
1891	106	133	111	129
1892	103	134	101	125
1893	99	132	98	122
1894	99	143	97	126
1895	101	151	101	137
1896	108	158	107	144
1897	110	162	104	142
1898	125	168	104	142
1899	118	171	118	149
1900	128	171	130	143
1901	127	177	125	145
1902	128	180	126	155
1903	132	184	130	158
1904	134	186	145	162
1905	138	189	148	178
1906	148	194	168	193
1907	157	199	191	205
1908	145	191	169	189
1909	152	200	171	188
1910	164	216	195	206
1911	165	211	205	218
1912	181	226	220	220
1913	186	233	237	228
1919	426	206	360	125
1920	505	206	602	162
1921	283	173	317	114
1922	262	200	324	157
1923	286	223	346	175
1924	330	250	360	185

Note: Figures from 1919–1924 (inclusive) are taken from the Board of Trade Returns.

Figures taken from the London *Economist*.

TABLE VI

NET TONNAGE OF VESSELS TRANSITTING THE SUEZ CANAL DURING EACH YEAR 1891–1924

(000 omitted)

DATE	GROSS TONNAGE	DATE	GROSS TONNAGE
1891	8,698	1909	15,407
1892	7,712	1910	16,581
1893	7,659	1911	18,325
1894	8,039	1912	20,275
1895	8,448	1913	20,033
1896	8,560	1914	19,409
1897	7,899	1915	15,266
1898	9,238	1916	12,325
1899	9,895	1917	8,368
1900	9,738	1918	9,251
1901	10,823	1919	16,013
1902	11,248	1920	17,574
1903	11,907	1921	18,118
1904	13,401	1922	20,743
1905	13,134	1923	22,730
1906	13,445	1924	
1907	14,728	1925	
1908	13,633		

TABLE VII

TABLE SHOWING QUARTERLY THE FLUCTUATIONS IN PRICE OF A NEW, READY 7500-TON CARGO STEAMER

DATE	AMOUNT	DATE	AMOUNT	DATE	AMOUNT
1898 a		1907 a	£40,700	1916 a	£160,000
b		b	41,000	b	180,000
c		c	——	c	187,750
d	£48,600	d	——	d	——
1899 a	55,750	1908 a	——	1917 a	187,500
b	——	b	36,000	b	——
c	48,750	c	——	c	——
d	51,000	d	——	d	165,000
1900 a	54,200	1909 a	——	1918 a	——
b	——	b	——	b	180,500
c	52,000	c	36,200	c	——
d	60,750	d	——	d	169,000
1901 a	——	1910 a	39,000	1919 a	169,000
b	49,250	b	36,400	b	195,000
c	51,000	c	——	c	——
d	——	d	——	d	232,500
1902 a	43,000	1911 a	39,750	1920 a	258,800
b	——	b	42,250	b	180,000
c	48,500	c	——	c	——
d	——	d	——	d	105,000
1903 a	47,200	1912 a	——	1921 a	105,000
b	50,400	b	——	b	82,000
c	40,200	c	52,000	c	63,750
d	39,200	d	58,000	d	60,000
1904 a	39,200	1913 a	55,000	1922 a	60,000
b	——	b	54,000	b	66,000
c	——	c	——	c	62,000
d	38,600	d	——	d	63,750
1905 a	41,300	1914 a	——	1923 a	65,750
b	37,750	b	42,500	b	65,800
c	40,000	c	——	c	62,500
d	42,500	d	55,000	d	60,000
1906 a	44,500	1915 a	60,000	1924 a	60,000
b	40,000	b	82,500	b	62,750
c	44,000	c	93,750	c	60,000
d	40,700	d	125,000	d	63,000
				1925 a	61,500
				b	——
				c	——
				d	——

Figures obtained from *Fairplay*.

TABLE VIII

Gross Tonnage of Shipping Under Construction in the United Kingdom at the End of Each Quarter 1882–1924

(Lloyds' Register)

(000 Omitted)

DATE	TONS GROSS	DATE	TONS GROSS	DATE	TONS GROSS	DATE	TONS GROSS	DATE	TONS GROSS	DATE	TONS GROSS	DATE	TONS GROSS	DATE	TONS GROSS
1882	890	1888	590	1894	725	1900	1260	1906	1400	1911	1350	1916	1423	1921	3798
	910		610		720		1265		1410		1475		1540		3530
	865		700		650		1200		1250		1450		1789		3282
	900		800		650		1260		1150		1510		1848		2640
1883	915	1889	910	1895	650	1901	1300	1907	1300	1912	1675	1917	2005	1922	2235
	900		880		710		1300		1250		1750		1867		1919
	880		875		720		1410		1075		1850		1879		1617
	800		875		715		1350		970		1950		1866		1468
1884	650	1890	860	1896	765	1902	1250	1908	850	1913	2060	1918	1879	1923	1492
	475		750		775		1100		800		2000		1815		1337
	410		650		650		1000		740		1987		1746		1271
	375		725		780		1020		760		1950		1879		1395
1885	400	1891	800	1897	830	1903	975	1909	910	1914	1890	1919	2254	1924	1473
	460		775		870		1025		750		1722		2524		1516
	425		700		875		900		775		1723		2816		1468
	380		790		1000		890		900		1627		2994		1296
1886	390	1892	840	1898	1175	1904	990	1910	1050	1915	1587	1920	3394		
	380		775		1300		990		1110		1506		3578		
	350		660		1350		1050		1150		1536		3731		
	360		575		1400		1050		1130		1363		3708		
1887	400	1893	620	1899	1385	1905	1250								
	425		610		1385		1300								
	400		620		1350		1325								
	440		650		1350		1350								

TABLE IX

GROSS TONNAGE OF MERCHANT VESSELS OF 100 TONS AND UPWARDS LAUNCHED IN GREAT BRITAIN DURING EACH YEAR FROM 1892 ONWARDS

(Lloyds' Register)
(000 Omitted)

YEAR	TONS GROSS	YEAR	TONS GROSS
1892	1,109	1908	929
1893	836	1909	991
1894	1,046	1910	1,143
1895	950	1911	1,803
1896	1,159	1912	1,738
1897	952	1913	1,932
1898	1,367	1914	1,683
1899	1,416	1915	650
1900	1,442	1916	608
1901	1,524	1917	1,162
1902	1,427	1918	1,348
1903	1,190	1919	1,620
1904	1,205	1920	2,055
1905	1,623	1921	1,538
1906	1,828	1922	1,031
1907	1,607	1923	645
		1924	1,439

TABLE X

TOTAL WORLD TONNAGE (SAIL AND STEAM) AS OF JUNE 30 OF EACH YEAR 1903–25

(thousands of tons gross)

DATE	TONS GROSS	DATE	TONS GROSS
1903	33,643	1915	49,261
1904	34,789	1916	48,683
1905	36,000	*1917	47,200
1906	37,554	*1918	48,044
1907	39,438	1919	50,919
1908	40,922	1920	57,314
1909	41,449	1921	61,974
1910	41,914	1922	64,370
1911	43,147	1923	65,166
1912	44,600	1924	64,023
1913	46,970	1925	
1914	49,089		

(Figures taken from Lloyds' Register)
*Figures taken from the Repertoire Generale of the Bureau Ventas: Lloyds publish no figures for these years.

TABLE XI

INDEX NUMBER OF SHIPPING FREIGHTS (ALL WATERS)
(Chamber of Shipping of United Kingdom)

(Average 1920 = base)

	1919	1920	1921	1922	1923	1924	1925
January		124	46	32.97	29.42	30.76	30.03
February		138	38	33.57	28.91	31.56	28.77
March		141	37	33.25	29.37	32.14	
April		127	39	30.96	32.22	31.09	
May		121	40	32.52	30.77	30.10	
June		112	43	29.83	26.68	29.09	
July		95	43	27.80	27.61	27.41	
August		85	40	27.84	25.03	27.84	
September		85	35	27.00	26.43	28.27	
October		93	30	28.33	27.33	30.13	
November		80	29	29.92	27.30	29.29	
December		58	33	31.04	28.06	28.21	

TABLE XII

INDEX NUMBER OF SHIPPING FREIGHTS (UNITED STATES TO EUROPE)

(Federal Reserve Board)
(January, 1920 = 100)

	1919	1920	1921	1922	1923	1924	1925
January		100.	43.3	27.1	22.9	24.9	26.9
February		90.3	38.5	29.1	21.1	25.8	25.5
March		83.4	35.9	28.3	21.9	24.8	25.6
April		83.5	39.0	25.4	22.6	25.3	
May		87.5	40.1	25.7	22.1	25.7	
June		90.0	37.6	25.7	21.3	23.3	
July		86.3	36.8	25.9	19.9	22.1	
August		78.5	36.7	24.6	20.0	22.4	
September		76.9	36.0	23.4	20.7	26.6	
October		75.4	32.3	22.7	22.9	28.1	
November		63.8	28.8	24.0	25.1	28.1	
December		53.6	27.2	24.4	25.1	26.8	

TABLE XIII

GROSS TONNAGE OF VESSELS ENTERED AND CLEARED WITH CARGO AT THE PORTS OF THE UNITED KINGDOM DURING EACH QUARTER 1919–1925

(000 Omitted)

	NET TONNAGE ENTERED			NET TONNAGE CLEARED		
	BRITISH	FOREIGN	TOTAL	BRITISH	FOREIGN	TOTAL
1919 a	4,596	990	5,587	4,909	2,608	7,518
b	5,356	1,620	6,977	5,482	3,361	8,843
c	5,936	2,506	8,443	5,563	3,066	8,630
d	6,185	2,373	8,558	6,008	3,561	9,569
1920 a	5,837	2,120	7,957	5,640	3,874	9,515
b	6,464	2,440	8,904	5,456	3,230	8,686
c	6,942	3,254	10,196	6,291	3,029	9,320
d	5,296	3,173	9,470	6,012	3,028	9,040
1921 a	5,679	2,648	8,327	5,142	3,034	8,176
b	6,280	2,703	8,983	4,204	1,319	5,524
c	6,695	3,492	10,187	7,260	3,426	10,686
d	6,469	3,154	9,623	7,674	4,335	12,010
1922 a	5,740	2,978	8,718	7,806	4,812	12,618
b	7,595	3,641	11,236	9,034	5,216	14,251
c	7,680	4,075	11,755	10,180	6,234	16,414
d	7,457	4,225	11,683	9,796	6,601	16,397
1923 a	6,717	3,963	10,680	9,290	7,018	16,308
b	8,784	4,296	13,081	11,275	7,313	18,588
c	8,697	4,826	13,523	10,775	6,891	17,667
d	8,876	4,923	13,799	10,800	7,300	18,101
1924 a	8,555	3,911	11,467	9,181	5,882	15,064
b	9,329	4,484	13,814	10,696	5,765	16,462
c	10,204	5,223	15,427	11,106	6,008	17,114
d	9,744	4,898	14,643	10,677	5,852	16,530
1925 a	8,378	4,132	12,511	9,752	5,443	15,195
b	9,697	4,272	13,940	10,377	5,076	15,454
c	10,080	4,580	14,660	10,747	4,940	15,688
d						

TABLE XIV

IMPORTS AND EXPORTS OF THE UNITED KINGDOM IN TONS WEIGHT 1919–1924

(Board of Trade)

(000 Omitted)

	IMPORTS	EXPORTS		
DATE	TOTAL TONS	COAL TONS	GENERAL TONS	TOTAL TONS
1913	56,000	76,687	16,913	93,600
1919	38,700	38,466	9,034	47,500
1920	45,500	28,863	12,337	41,200
1921	35,900	26,247	11,753	38,000
1922	44,000	67,247	12,061	80,000
1923	52,000	84,487	14,013	98,500
1924	58,500	65,532	14,568	80,100

TABLE XV

Shipping Laid Up in British Ports

DATE	BRITISH VESSELS		TOTAL BRITISH AND FOREIGN VESSELS	
	NUMBER	TONS NET	NUMBER	TONS NET
1921				
January 1			614	1,504,000
April 1				
July 1				
October 1				
1922				
January 1	631	1,886,000	712	2,091,000
April 1				
July 1				
October 1				
1923				
January 1	363	648,912	403	709,224
April 1	293	506,372	321	546.555
July 1	347	667,527	372	709,102
October 1	374	727,134	395	755,101
1924				
January 1	301	605,585	317	629,763
April 1	241	391,337	255	410,356
July 1	294	447,622	310	470,073
October 1	265	307,999	278	333,820
1925				
January 1	319	469,951	332	488,252
April 1				
July 1				
October 1				

(Compiled by the Chamber of Shipping of the United Kingdom from returns supplied by the chief Dock and Harbour authorities in the United Kingdom and reproduced by permission.)

TABLE XVI

TONNAGE OF VESSELS ENTERED AND CLEARED WITH CARGO AT PORTS OF UNITED KINGDOM

(000's of Tons Net)

DATE	ENTRANCES			CLEARANCES		
	BRITISH	FOREIGN	TOTAL	BRITISH	FOREIGN	TOTAL
1880	17,018	6,975	23,993	18,867	6,817	25,685
1881	16,864	6,360	23,224	19,605	6,731	26,336
1882	17,810	7,004	24,815	20,392	7,306	27,698
1883	19,186	7,124	26,310	22,136	7,237	29,373
1884	18,209	6,487	24,696	21,946	7,326	29,273
1885	18,759	6,905	25,664	21,885	7,432	29,317
1886	18,220	6,462	24,683	22,065	7,041	29,107
1887	19,311	6,688	25,999	23,115	7,055	30,170
1888	20,115	6,961	27,077	24,126	7,537	31,664
1889	21,077	7,440	28,517	24,766	8,282	33,048
1890	21,139	7,839	28,978	25,267	8,590	33,857
1891	20,346	7,754	28,100	25,187	9,025	34,213
1892	21,356	8,173	29,529	25,063	8,880	33,943
1893	20,962	7,833	28,795	24,495	8,456	32,952
1894	22,726	8,414	31,141	26,682	9,094	35,777
1895	22,991	8,366	31,358	26,933	9,338	36,272
1896	24,629	8,850	33,479	27,726	9,977	37,703
1897	25,339	9,296	34,636	28,101	11,206	39,308
1898	25,171	9,343	34,515	27,959	11,503	39,462
*1899	25,453	10,772	36,225	28,968	14,019	42,988
*1900	24,426	11,760	36,186	27,906	15,765	43,671
*1901	24,654	11,682	36,337	28,301	15,016	43,317
*1902	25,800	12,103	37,904	29,534	15,267	44,802
1903	27,448	12,454	39,903	31,316	16,083	47,399
1904	27,807	12,134	39,941	31,893	16,573	48,466
1905	27,994	12,001	39,996	32,762	16,860	49,623
1906	29,146	12,812	41,959	35,445	18,852	54,298
1907	29,265	12,136	41,402	37,146	20,698	57,844
1908	28,051	12,138	40,189	35,284	21,325	56,909
1909	28,355	11,960	40,315	36,240	20,953	57,194
1910	29,121	12,497	40,618	36,238	21,088	57,326
1911	29,455	12,490	41,946	47,100	22,163	59,263
†1912	31,143	15,204	46,348	37,398	24,637	62,036
1913	32,292	16,771	49,064	40,101	27,718	67,819
*†1914	28,928	14,131	43,060	32,515	23,452	55,968
*1915	22,861	10,862	33,723	20,380	19,148	39,529
*1916	20,217	9,842	30,059	17,751	17,843	35,595
*1917	18,795	4,433	23,228	16,926	9,149	26,075
*1918	19,819	3,414	23,233	14,965	7,771	22,737
1919	22,079	7,491	29,570	21,962	12,599	34,562
1920	25,506	10,986	36,493	23,532	13,192	36,725

*Vessels in government service not included.
†Increase in figures due to changes in method of recording tonnage.

WESTBROOK PUBLISHING COMPANY
PHILA.
WPCo